

# **ELECTRICAL CONSTRUCTION AND MAINTENANCE**

**JANUARY • 1957**

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WITH ELECTRICAL CONTRACTING

**OUTLOOK FOR 1957** Trend lines and  
forecasts for electrical construction activity.

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## **50 IDEAS**

**A SPECIAL EDITORIAL REPORT  
ON ELECTRICAL MAINTENANCE  
METHODS.**

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**ELECTRICAL WEEK** How to tie in with  
**NEW** activities next month — Practical worksheets  
to help you sell residential, commercial and indus-  
trial prospects.

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**56** TH YEAR



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January 1957

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# Sidelights

**"SYSTEMS DESIGN" IN BOOK FORM**—Last May we published a book-length editorial feature "Modern Electrical Systems Design". In spite of a generous over-printing of the issue, the entire supply of extra copies were snapped up within a few weeks. We announced, shortly afterwards, that negotiations were under way to release the data, enhanced by additional material, in permanent reference book form.

About the time you receive this issue, we are happy to report, the new book will be available. "Modern Electrical Systems Design" by J. F. McPartland and the Editors of Electrical Construction and Maintenance, is published by the McGraw-Hill Book Company, 330 West 42nd St., New York 36, N. Y., and priced at \$6.00 per copy.

**NATIONAL ELECTRICAL WEEK**—In anticipation of National Electrical Week beginning February 10, we are devoting a special editorial feature section this month to practical suggestions for our readers on how to tie in with this national educational and promotional activity and some practical work-sheets to expedite planning and selling residential, commercial and industrial modernization projects.

Reprints of the work sheets are available at a nominal cost. Quantity prices will be quoted on request. Address a card or letter to Worksheets, Electrical Construction and Maintenance,

330 West 42nd Street, New York 36, N. Y.

**NATIONAL LIGHTING COMPETITION**—Plans are underway for a national lighting competition to be launched formally in March 1957. The contest, offering cash prizes, certificates and nation-wide recognition for superior installations in several classifications, will be conducted jointly by Electrical Construction and Maintenance, Electrical Wholesaling, and Electrical World, with the cooperation of the Commercial and Industrial Lighting Section of the National Electrical Manufacturers Association.

Berlon C. Cooper, eastern editor of Electrical Construction and Maintenance and nationally known lighting authority, will be Chairman of the contest committee.

**THE OUTLOOK IS GOOD**—Each year at this time, it is the historic responsibility of the editor to examine the activities of the field he serves, to explore its prospects and to estimate its potentials for the year ahead. Our forecast begins on page 85.

The outlook for this year of 1957 is, as might be expected, strongly favorable for a continuation of prosperity in the national economy and further growth in the electrical industry. From existing statistics, obvious trends, and from plans already committed beyond recall, it would take a perverse logic indeed to reach

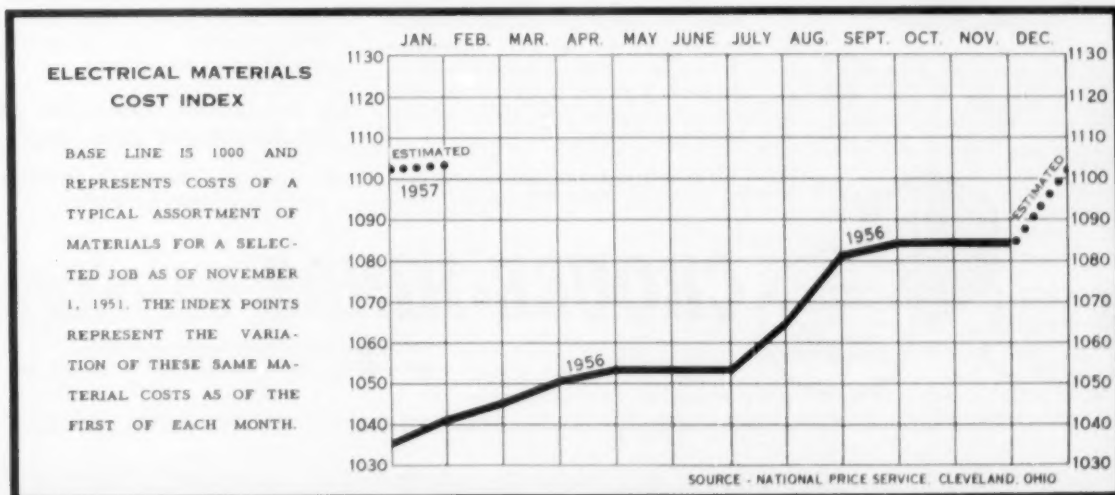
other than an optimistic conclusion at this time.

For those who may be skeptical, the art of forecasting market patterns and trends has come a long way in a relatively few years. The crystal ball and the educated guess are obsolete. The historical chart projected by reasonable probability is easier to use and greatly reduces the area susceptible to the frailties of individual judgments. Actually, forecasters and market researchers are not so much concerned about methods of projection as they are about the accuracy or completeness of the statistical data from which the projection is made.

Within the limits of current knowledge, therefore, useful and reasonably accurate projections are feasible. In indelible type they should be able to stand future review. The chances are our forecasts for '57 will stand up to critical reading next year at this time.

**BUSINESS BUILDERS**—Underground service drops to residential and commercial properties in suburban districts are becoming fashionable. The inherently more expensive connection is an easy extra where appearance is a consideration.

Electric space heating for schools ought to "break through" this year. With any reasonable power rate all other cost factors are favorable and the new technique should be carefully appraised for both new construction plans and additions to existing buildings.





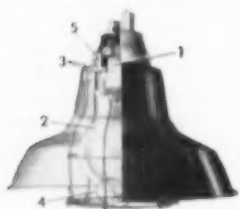
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# Washington Report

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**Another record year seems assured** for the national economy as 1957 gets under way (and paves the way for another record year in electrical construction—see "Outlook for 1957", page 85). Major strength factors bolstering the 1957 economic outlook include an estimated \$425 billion gross national product, \$46.5 billion (11% of GNP) new construction volume, rising disposable personal income, high-level employment, stabilizing influences on the value of the dollar, continuing high industrial production, and a reversal of the downtrend in farm prices.

Troublesome factors in the economy are present, but perhaps pose less of a real threat than the over-emphasis by many would indicate. The two biggest are the housing slowdown, and increasing interest rates on mortgages and credit. The drop in auto sales last year from the high 1955 rate caused considerable concern, but sales are now on the increase and outlook for 1957 auto sales is for a jump of 10% or more from last year. Labor shortages, particularly in certain specified skills, are giving some concern and acting as a partial brake on the economy.

**Business during 4th quarter 1956 was sparked** by rising personal income and expanding business investment, Commerce Dept. reported. However, the report noted that slow advances in costs continued to exert pressures on industrial prices, and that wholesale prices advanced to an average level 4% above last year. Strong 4th quarter indicators included: new high in employment, continuing gains in industrial production, continuing demand for steel to keep production in excess of 100% of capacity, continuing strength in capital goods business, and record rate for new construction.

**Employment in November was a record 65.3 million** jobholders, 461,000 more than in November 1955. Unemployment was 2.5 million, up 62,000 from a year earlier. The civilian labor force increased by 525,000 during the year.

**Industrial output in November was a record 149%** of the 1947-49 average, FRB reported. This was one percentage point below October's 150% rate, but 5% ahead of November 1955.

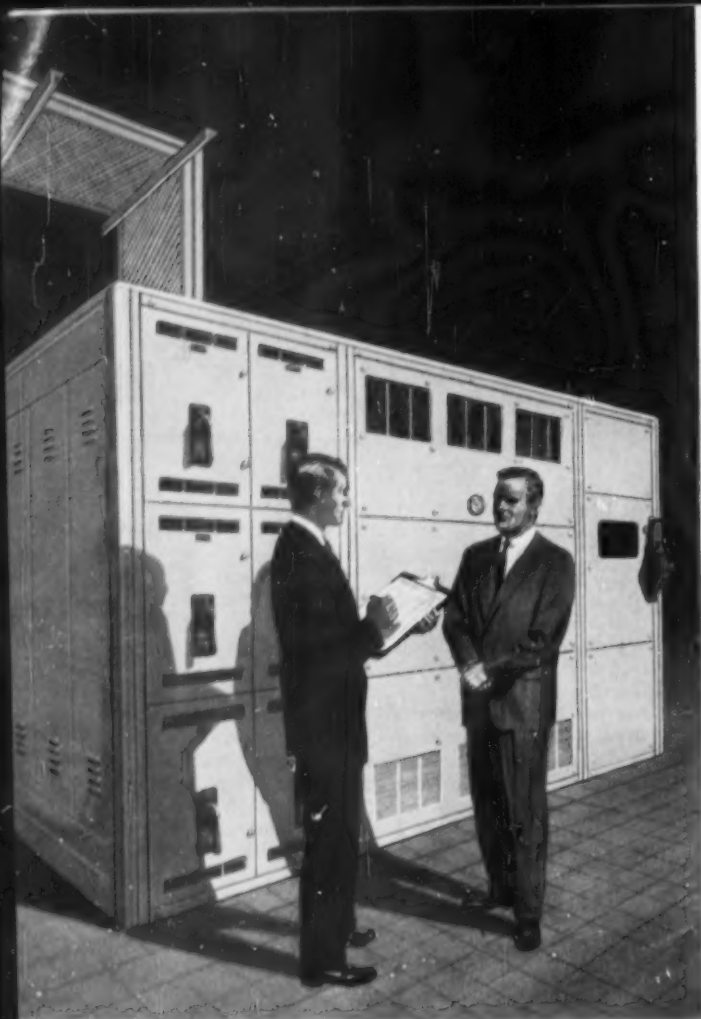
**Electric power output in December** averaged about 12.1 billion kwhr weekly, or over 5% ahead of a year earlier. Breaking through the 12 billion kwhr mark was attributed to electric heating for colder weather, electric lighting for the darker winter days, and nationwide exhibitions of Christmas lighting.

**IBEW was certified by FHA to buy mortgages** insured by the agency recently, as Gordon Freeman, International Brotherhood of Electrical Workers international president expressed the hope that his union would be able to invest in FHA-insured mortgages monthly. Union officials added that as much as \$10 million might be invested annually.

**Orders for copper products are on the decline**, while copper stocks mount. Lagging demands for copper have forced prices down to 33¾ cents on the London market, 35 cents on the domestic market in late December, while domestic stocks mounted to 116,576 tons compared with 47,053 tons a year earlier.

Steel production during last November was highest on record, for 10,566,000 tons. In October, a monthly record was set for any month at 11,045,513 tons. Forecast for 1957 is for some 125,000,000 tons, or more, up from last year's 117 million tons.

Aluminum production is nearing the 2-million-ton annual rate as demand slackens and capacity continues to expand. A slow turn from shortages to surplus seems to be in the making as capacity and imports outgrow demands.



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## ***Financial Aid to Higher Education***

# **A Fine Start, But...**

**This editorial has two purposes. The first is to salute American business for the fine start it has made in helping to relieve the financial plight of our colleges and universities. The second purpose is to stress the importance of having business provide more financial aid, and soon.**

### **How Business Helps Higher Education**

Business contributions to higher education doubled between 1950 and 1955. They jumped from \$40 million to \$80 million. Preliminary figures indicate they will be even higher this year.

Business firms have also shown a lot of ingenuity in devising different ways of making their contributions. The methods range from a matching of an employee's contribution to his particular alma mater to wide diffusion of the money through state and regional money-raising associations of colleges and universities. Thanks to this ingenuity, business firms now have a wide choice of ways by which to give effective aid. The way most appreciated by college administrators is the making of gifts unrestricted as to the purpose for which the money is used.

Imposing as it is, however, what business has done thus far is only a good start. Only a tiny fraction of the total number of business firms in the country are giving direct financial help to our colleges and universities; and this fraction includes fewer than half of the hundred largest corporations in the country. Also, the amount of financial help being provided by business constitutes only a very small fraction of what is needed.

### **Why Colleges Need More Aid**

Right now our privately endowed colleges and universities need about \$350 million more in operating income a year than they are receiving to enable them to pay decent faculty salaries and be in tolerably good working order otherwise. The reasons, including a severe decline in the purchasing power of their endowment income because of price inflation, have been dealt with in the previous editorials in this series.

In addition, these institutions, together with the tax-supported schools, are faced with a tremendous increase in enrollment over the years ahead. With both a rapidly increasing population of young people and an increasing propor-

tion of them going to college, this year's enrollment of 3.2 million students is expected to reach 4.0 million by 1960, and to be doubled by 1970.

For the next ten years our privately supported colleges and universities must have an average of about \$400 million a year above what they can be expected to collect from tuition fees, income from endowment funds, etc.

This figure of \$400 million does not include what is needed for new buildings and equipment. It also does not include help for tax-supported schools above what they get from taxes, fees, etc. Business has given and will continue to give these schools substantial aid. Indeed, almost 25% of the financial help from business for our colleges and universities went to tax-supported schools in 1955.

If aid from business met their needs for increased operating income, the privately supported colleges and universities would be given a decisive lift in performing successfully their part in our system of higher education. They would still have large needs of capital equipment — buildings, dormitories, laboratories — but help from other sources, such as that provided by devoted alumni, where they are well organized, could be expected to go far toward meeting these needs. Also some companies prefer to concentrate on meeting needs of this type.

### **What 1% of Profits Would Do**

But do business firms have the capacity to fill the gap in adequate operating income for our privately endowed colleges and universities without putting an excessive financial burden on themselves? Those who have studied this capacity carefully say that the answer clearly is yes. If, of its profits before taxes — this year an estimated \$43 billion — business were to devote 1% to helping our privately en-

**dowed colleges, it would take care of present operating needs of about \$350 million a year. And the balance of \$80 million would be a big step in meeting their needs for new buildings and equipment, too.**

About one half of a 1% contribution of this sort would, in effect, be made by the federal government. Up to a limit of 5%, contributions of this type are exempt from the federal corporate income tax. For corporations with incomes above \$25,000 per year this tax is 52%.

It is clear that not all business firms are in shape to devote 1% of their profits to aid to higher education. Even in this year of record-breaking prosperity, many of them will have no profits at all. But if business generally would take 1% of pre-tax profits as a target or benchmark for financial help to our privately endowed colleges and universities these institutions would again have sturdy financial foundations.

Relatively this is a very small price to pay (1) to insure a continuing supply of competently trained young men and women and (2) to buttress our freedom by assuring the successful survival of the privately supported sector of our system of higher education.

*This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.*

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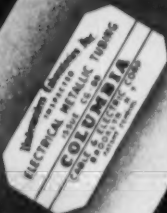
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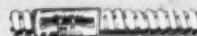
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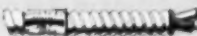
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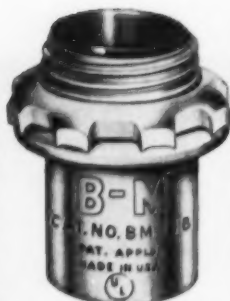
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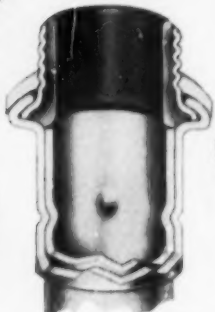
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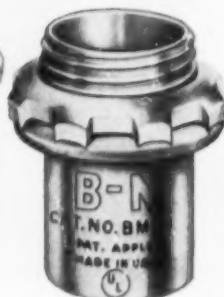
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All B-M Indenter Fittings are U.I.  
Approved as concrete-tight and  
all Compression Fittings as rain-  
tight as well as for general use  
(File Card E10863). Also comply  
With Federal Specifications  
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**BRIEGEL** **METHOD  
TOOL  
CO.**  
**GALVA, • ILLINOIS**

**SOLD ONLY THROUGH ELECTRICAL WHOLESALERS**



**GOOD BENDS**

**COME EASY**

*because*

**THERE'S UNIFORM  
HIGH-DUCTILE STEEL  
IN XDUCT CONDUITS**

Good accurate bends are easy with Xduct Conduit because only easily-formed, high-ductile steel is used as the basic metal. Xduct resists deformation and spring-back, and the silver-bright uniform zinc coating does not flake, crack, or peel under bending pressures.

All Xduct threads are machined (and couplings tapped) before galvanizing so that all joints are zinc protected equally as well as conduit surfaces.

There's easier fishing with Xduct's baked-on aluminum enamel interior coating . . . easier pulling of wires because friction is minimized between conduit wall and conductor insulations.

To find out more about Xduct's easy bending, easy fishing and end to end zinc protection, write for your free copy of the Xduct facts booklet.

**For Dependable Pathways of Power**

**National Electric Products**

PITTSBURGH, PA.

2 Plants • 11 Warehouses • 35 Sales Offices



# East Side- West Side

ALL AROUND THE TOWN

TRIANGL

## 4,000,000' of **TRIANGLE** Trioprene Underground Cable

Four million feet of cable may seem like a lot to bury in the ground—but not to Con Edison. That's only a part of their expansion program to meet the power demands of growing New York. Today's demands and tomorrow's.

Secondary network cable is so important a part of their distribution system, Con Edison engineers require a product which will operate satisfactorily under the conditions that exist in their underground system.

Triangle Trioprene Secondary Network Cable answers this demand. It is insulated with a low moisture absorption rubber compound and protected with a tough, heavy duty jacket, resistant to heat, sunlight, moisture, abrasion, oils, grease, acids, alkalis and most solvents. Because of the excellent aging characteristics of the Neoprene Jacket, it retains its protective qualities for long periods of time even under adverse conditions.

Get all the facts on Triangle Trioprene—write today for literature.



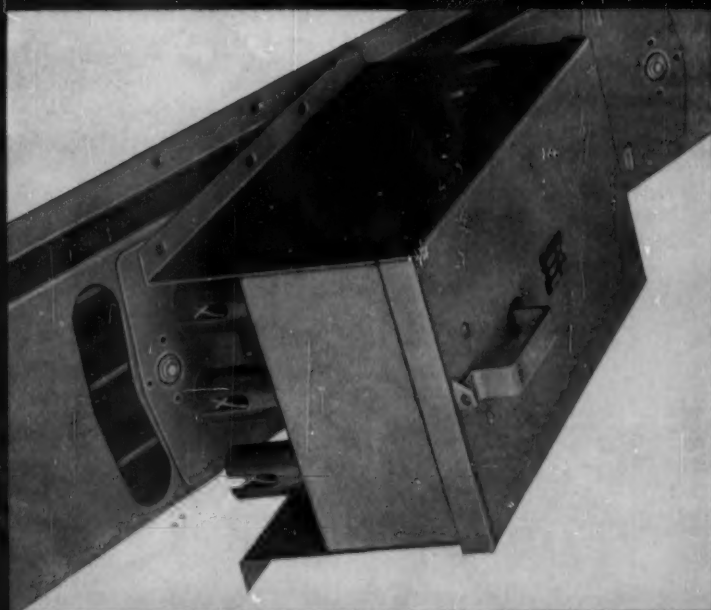
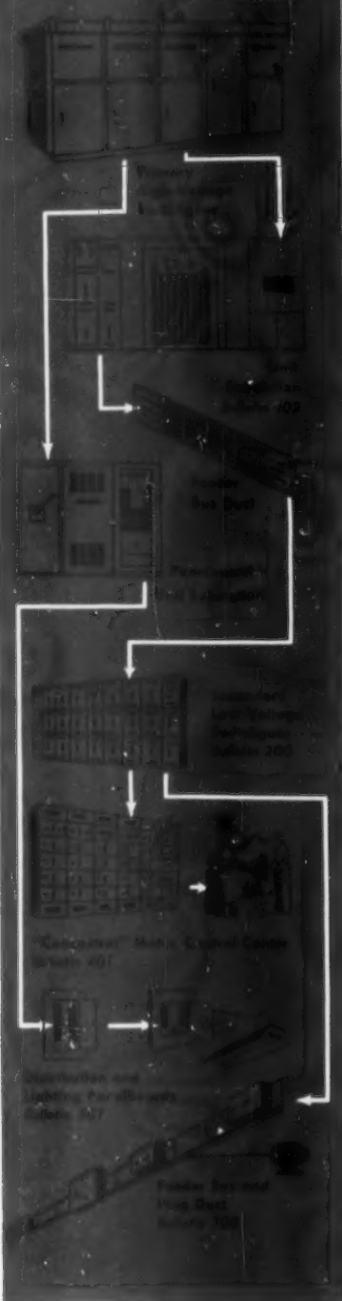
## **TRIANGLE**

*Conduit and Cable Co., Inc.*

NEW BRUNSWICK, NEW JERSEY



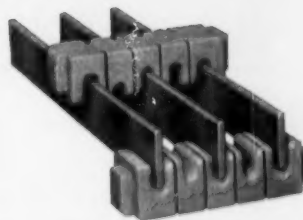
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## **Relocate Power in MINUTES not days with "PLUG DUCT"**

CONTINENTAL pre-fabricated Plug Duct systems slash non-productive labor costs by quickly and easily providing power to relocated machines. Wide variety of fittings and accessories allows installation in any plane or direction. Copper or aluminum conductors are standard on all sizes.

Standard lengths and fittings immediately available from authorized distributor stock or factory warehouse.



**TWICE AS MANY INSULATORS  
AT HALF THE USUAL SPACING**

for greater electrical  
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*Compare for yourself.  
Write for detailed  
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- Completely Safe
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- Plug-in Every 12 Inches
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**CONTINENTAL** ELECTRIC EQUIPMENT CO.

General Offices: 204 West 4th St., Cincinnati 2, Ohio

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# Wagner®

## TRANSFORMERS

...the choice of leaders  
in industry



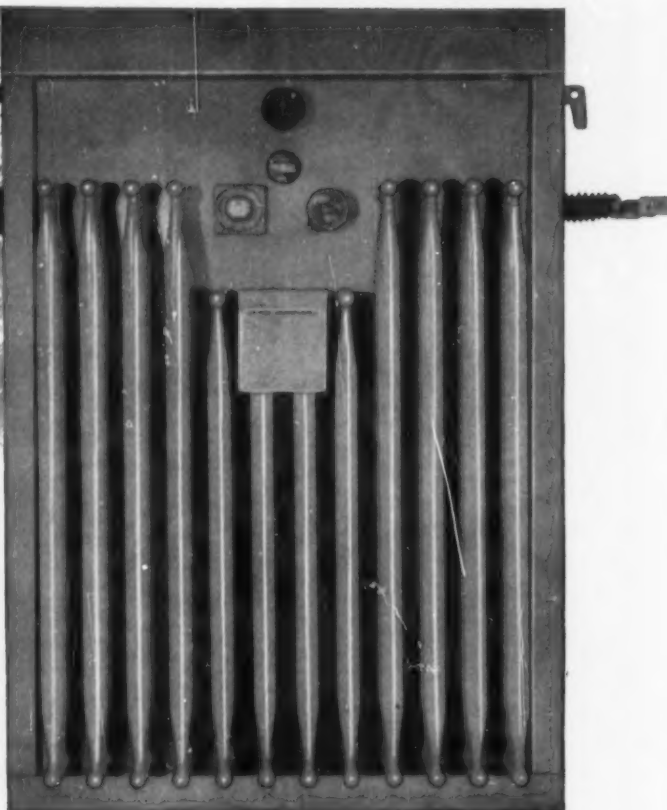
## PLANNING A NEW LOAD CENTER?

**...with the Wagner  
Close-Coupled Transformer,  
you can build a compact, modern unit substation**

These Unit Substation Transformers save space... make a neat, streamlined installation

Wagner close-coupled, liquid-filled unit substation transformers can be easily flush-mounted with co-ordinated switchgear. And when they are, the result is a neat, modern, compact installation that not only saves space in your plant, but looks better too.

You get quicker delivery on a close-coupled Wagner transformer because there are fewer engineering difficulties than with the throat-connected type. It's not necessary to co-ordi-



nate the bushing height of a close-coupled unit to match special switchgear. Bushing heights are designed to give ample room to make connection to switchgear or busses in the switchgear compartment or transition section. No need for special throats to match special switchgear.

Look to Wagner for transformers that assure a continuous dependable flow of power. Your nearby Wagner engineer will be glad to help you solve your load-center problems. Call the nearest of our 32 branch offices or write us.



**Wagner Electric Corporation**

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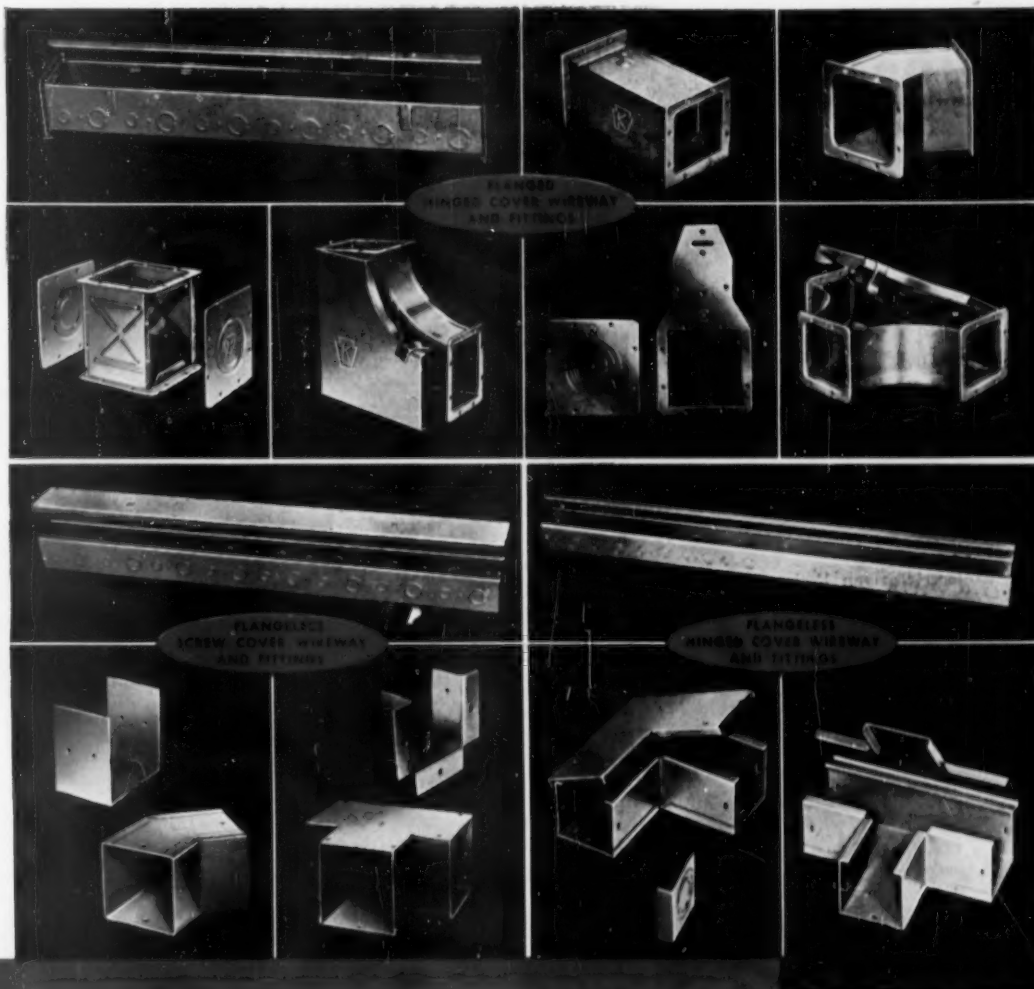
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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

16

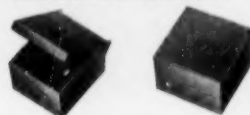
ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JANUARY, 1957



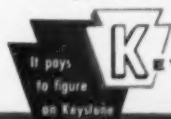


**FOR BETTER JOBS AND EXTRA PROFITS, SPECIFY THE  
KEYSTONE QUALITY LINE**

**CABINETS AND PULL BOXES**



No doubt about it! When it comes to wiring installation jobs, you can get *what you want when you want it* from the Keystone Quality Line. Wireways, for example, are available in both flanged and flangeless styles . . . with hinged or screw covers . . . with or without knockouts . . . and in sizes ranging from 2½" x 2½" x 1' through 8" x 8" x 5'. There's a wide selection of auxiliary fittings to choose from, too, plus cutout boxes and pull boxes in more than 50 different stock sizes . . . and a variety of telephone and current transformer cabinets to meet your exact requirements. And if it's outlet boxes or switch boxes you're looking for, you'll find that Keystone has them . . . in almost every type and size, with proper covers, too. What's more, every item in the Keystone Line is quality-built, priced right, and stocked for immediate shipment direct from factory warehouses! Want more information? Send for your free copy of the new illustrated Keystone catalog today!



**KEYSTONE MANUFACTURING COMPANY**  
23328 SHERWOOD AVENUE • CENTER LINE (Detroit) MICHIGAN

**SOLD ONLY THROUGH RECOGNIZED ELECTRICAL DISTRIBUTORS**

# Another NEW BLACKHAWK

## NEW 3" and 4" featherweight benders

### FOR BENDING UP TO 3" PIPE

S-139 assortment with electric-driven hydraulic pump — or S-138 assortment with hydraulic hand pump. Both for 1¼, 1½, 2, 2½ and 3" diameters.

### FOR BENDING UP TO 4" PIPE

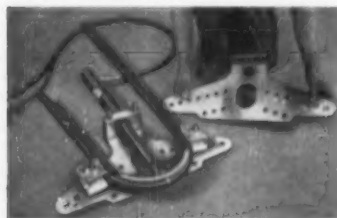
Model S-140 assortment with electric-driven hydraulic pump. For 1¼, 1½, 2, 2½, 3, 3½ and 4" diameters.

### FOR BENDING UP TO 4" PIPE

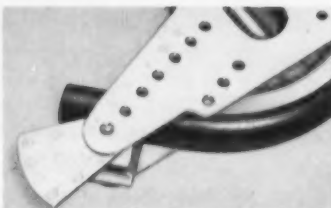
S-137 assortment with P-85 hydraulic hand pump . . . for 1¼, 1½, 2, 2½, 3, 3½ and 4" diameters.



**ALUMINUM REMOVABLE TOP PLATE . . . "LOCK-ON" SHOES** — No threading of shoes on ram — simply place them in position and insert lock pin. Pipe is quickly positioned from above rather than "muscle" in from side. Top-plate has snap-action, quick-lock bolt.



**NEW LONGER-STROKE RAM** — Has full 12-inch travel. Makes 90° bends in one stroke and with only one setting of the pipe in the shoes. Also forms up to 180° bends faster than ever.



**"OPTIK-ANGLE" GAUGE** — Stops guesswork and time-wasting measuring in controlling degree of bend. The exact angle of bend is constantly in view. Gauge is mounted right on bender.

**ALUMINUM ALLOY FRAME AND SHOES — STRENGTH WITH LIGHT WEIGHT!** — Rigid and strong — yet surprisingly light weight — means greater portability, easier assembly on bench, floor, makes overhead bending a cinch. Smooth action S-139 turns out uniform factory-like bends — makes big savings in time and materials compared to manufactured dies. The new Blackhawk is by far the easiest to use, fastest bender on the market today. Keeps electrician crews happy too!



"Porto-Power"



Hydraulic Pipe Benders



Electrically Driven Hydraulic Pumps

• **BLACKHAWK bends prove**

# aluminum "1-bite" bender!

**NOW!** Make 90° bends in 1¼" through 3" pipe in one pass!\*

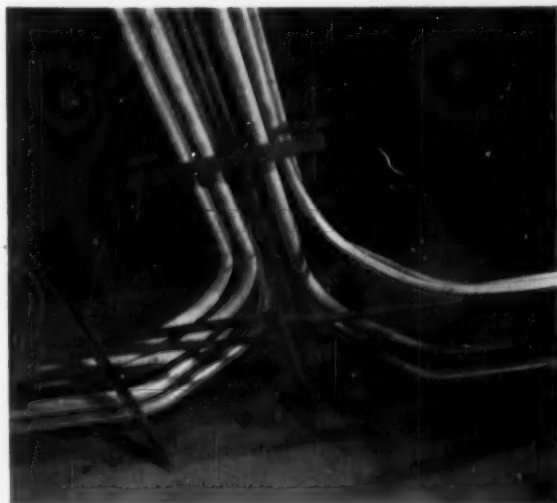
It's another Blackhawk exclusive — ! No other bender on the market can match the performance of Blackhawk's featherweight S-139 ALUMINUM Bender. It's super-portable — easy to tote — easy to set-up. Weighs just 103 pounds — ready for work. Makes 90° bends in 1¼" to 3" pipe in one pass! Only 3 quick settings needed for 3½" and 4" bends.

You'll be amazed how easy it is to make factory-like bends. And your crews will get more work done with these "1-bite" benders. Users' records prove Blackhawk with an electric-powered hydraulic pump pays for itself in only 35 bends — saves up to 75% over cost of manufactured bends.

Switch to years-ahead design Blackhawks from the complete line of preferred Blackhawk Benders . . . for ½" — 2" thin-wall conduit and 1" — 4" rigid conduit and pipe. Select from a wide range of sizes and prices.

Available from your electrical or industrial supply house.

\*Only 3 quick set-ups needed for making 3½ and 4" bends.



## Whopping big 77% bending cost saving with BLACKHAWK Bender!

Foreman Norman Melder, using new Blackhawk electric-powered hydraulic bender — saved 77% forming 3½" conduit — compared to cost of manufactured elbows! Melder says, "We recently installed 65,400 feet of conduit for wiring systems in a medical center. Our Blackhawk bender not only saved time but money too. Here's a record of how much we saved on various sizes of conduit compared to the cost of manufactured bends —

- We saved 67% on 2" diameters!
- We saved 68% on 2½" diameters!
- We saved 72% on 3" diameters!
- We saved 77% on 3½" diameters!

"That's why we're sold on Blackhawk. You can bet Blackhawk will be our regular production bender from here on in."



MR. NORMAN MELDER  
Project Foreman  
Dietz Electric Co.



CHARLIE JOHNSON  
Electrician  
Dietz Electric Co.

**CALL YOUR  
ELECTRICAL OR  
INDUSTRIAL SUPPLY  
HOUSE TODAY!**

# BLACKHAWK®

Blackhawk Mfg. Co. Dept. P-2017  
Milwaukee 46, Wisconsin



Hydraulic  
Knock-Out  
Punches

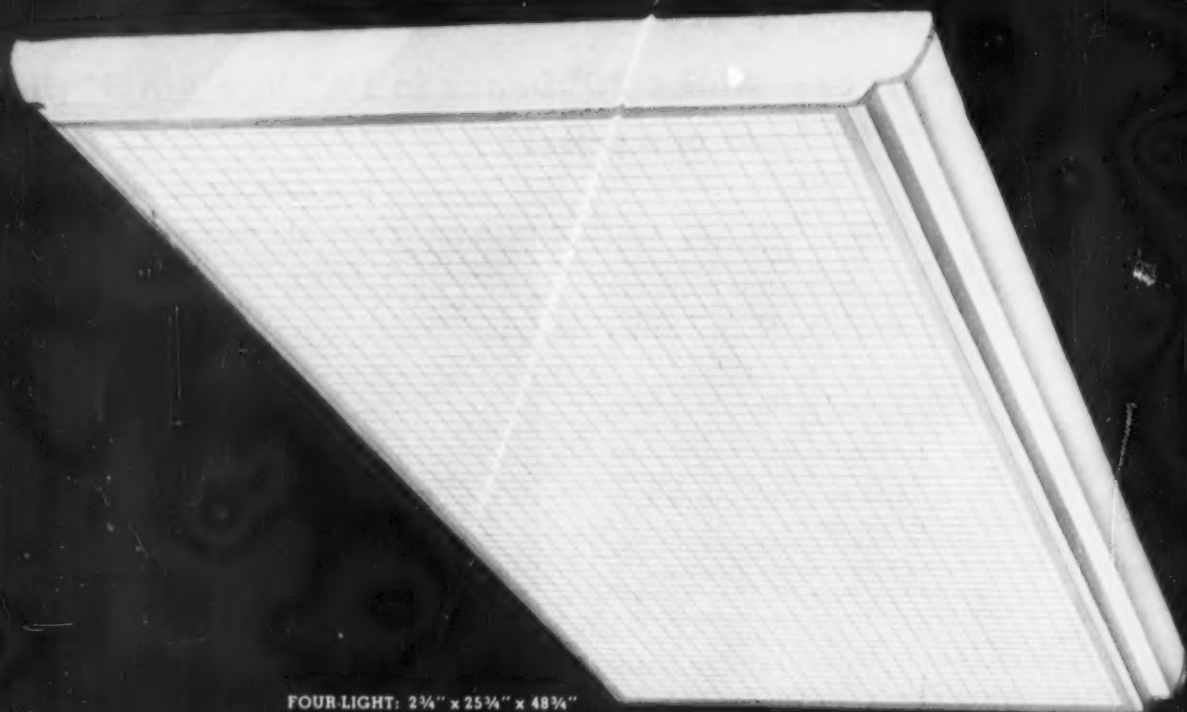


Gauge-Equipped  
Jacks

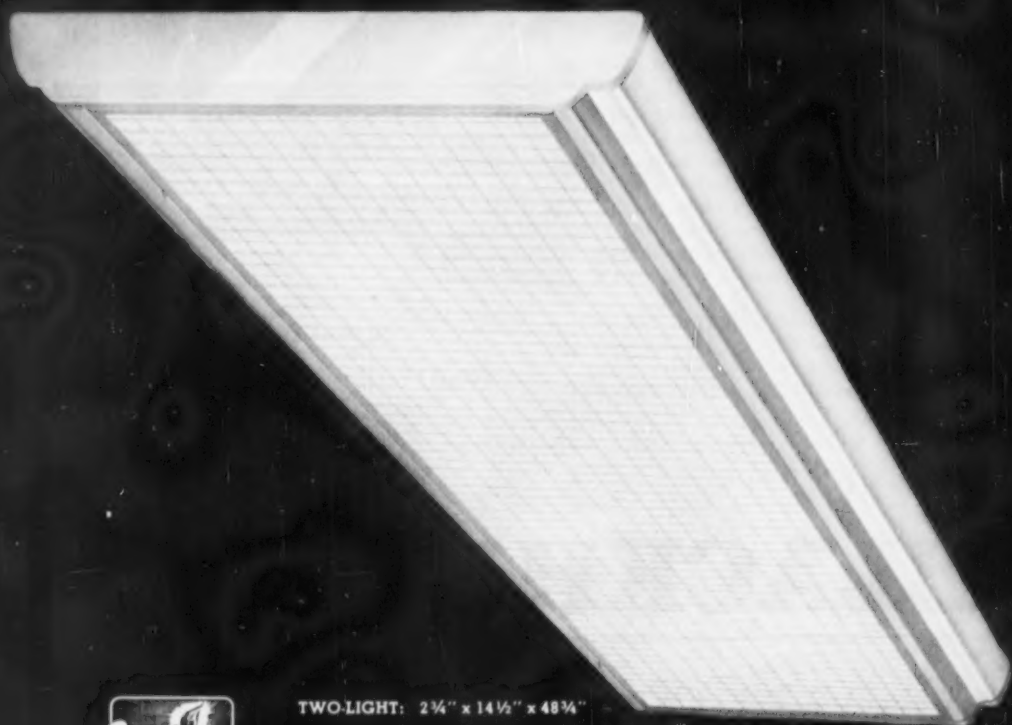


Hydraulic Jacks  
thru 100-Tons

**BLACKHAWK'S best!**



FOUR-LIGHT: 23 1/4" x 25 1/4" x 48 3/4"



TWO-LIGHT: 23 1/4" x 14 1/2" x 48 3/4"



GIBSON MANUFACTURING COMPANY

# the new Gibson

## Ceilo • 35

**ONLY 2¼" DEEP — AND NO DARK AREAS!**

In this striking new fixture, Gibson designers have achieved maximum thinness, with no dark panels or strips in the diffusing area. Parabolic reflectors and a unique way of mounting the ballasts provide a smooth, unbroken panel of light in a fixture of incomparable quality and beauty.



#### **PARABOLIC REFLECTORS**

The parabolic reflectors reflect all light straight down and thus provide an even distribution of light over the entire diffusing area.



#### **FINGER-TOUCH RELAMPING**

Just a touch of the fingertips to the louver latches allows the louver to swing open for relamping. Snap—and it's back in place.

Write today for complete information about the beautiful new Ceilo-35

Makers of the world's  
most versatile fixtures



FAT. FEND.

1919 Piedmont Circle, N.E., Atlanta 9, Ga.



# Familiar symbols of safety

## PROTECTION IN THE AIR



### FOR YOUR WIRING PROTECTION

Standard-threaded rigid steel conduit is the **only** wiring system approved today by the National Electrical Code as moisture-, vapor-, dust- and explosion-proof for use in hazardous locations and occupancies.

Youngstown Buckeye full-weight rigid steel conduit is the answer to all problems of safe and efficient functioning of your electrical wiring systems in any type location. On the job, you will find it's easier to fabricate—easier to fish wires through—and above all, Buckeye Conduit will save you money because its excellent corrosion resistance always provides a much longer, untroubled service life.

Remember, because Youngstown is the only producer of rigid steel conduit controlling all processes from ore mining to bundling the finished product, you can be certain each length contains the same high quality that has made it the accepted standard of owners, architects and contractors everywhere.

Ample stocks of our distributors will keep your jobs on schedule—and cover emergency needs whenever they arise. Call today for that famous quality and service built into every Youngstown product.

## THE YOUNGSTOWN SHEET AND TUBE COMPANY

*Manufacturers of Carbon, Alloy and Yaloy Steel*

General Offices - Youngstown 1, Ohio

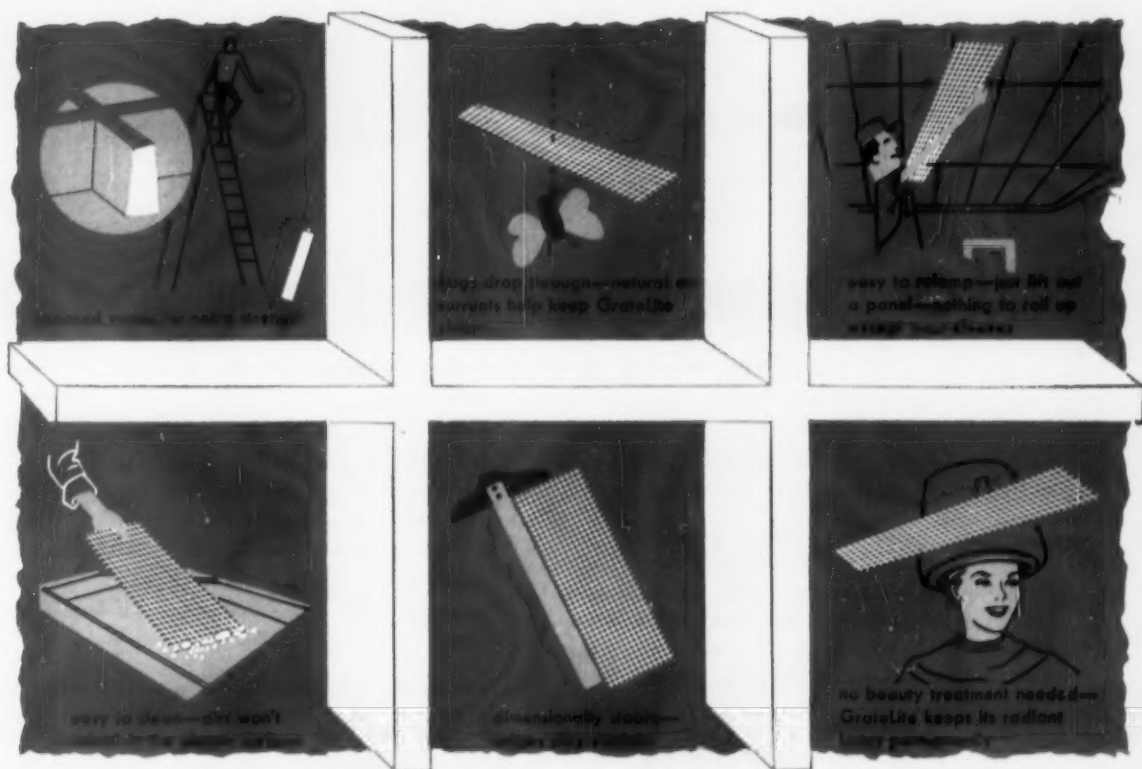
District Sales Offices in Principal Cities



Ask your distributor for  
**Youngstown Buckeye Full  
Weight Rigid Steel Conduit**  
  
and  
**Youngstown Electrical  
Metallic Tubing.**



**GRATELITE\* STAYS GOOD AS NEW** year in-year out...  
**needs no babying...**



**CEILING OF GUTH GRATELITE LOUVER-DIFFUSER GIVE BETTER LIGHT LONGER**

MAY WE SEND YOU DETAILED INFORMATION?

**THE EDWIN F. Guth COMPANY • ST. LOUIS 3, MO.**  
 TRUSTED name in lighting since 1902

\*U. S. Pat. No. 2,745,001  
 Canadian Patent Pending



Mr. Gerholz (left) at the site of his Westgate Park community in Flint, Michigan. With him is Edward Rozsypal of Michigan Bell Telephone Company.

## "Concealed telephone wiring is a 'must' for modern homes"

—says Mr. Robert P. Gerholz of Gerholz Community Homes, Inc., Flint, Michigan

"We're building 800 homes in our Westgate Park community," says Mr. Gerholz, "and in each of them we're providing several telephone outlets.

"In my opinion, concealed telephone wiring is a sign of a well-integrated, preplanned home. Home buyers are learning to ask for it, progressive builders are providing it. I think it will soon be difficult for any builder to sell a home that doesn't have concealed telephone wiring. It's a 'must' for modern homes."

Mr. Gerholz is the only man ever to have been President of both NAHB (1944) and NAREB

(1950). In his 35 years as a builder he has built over 4200 homes. His Westgate Park community of homes in Flint, Michigan, has twice received the NAHB's Award of Merit, in 1954 and again in 1955. Like many other trend-minded builders across the nation, Mr. Gerholz knows the value of concealed telephone wiring as a modern sales feature.

Your nearest Bell Telephone business office will help you with concealed wiring plans. For details on home telephone wiring, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

Meet us at the NAHB Convention, January 20-24, Conrad Hilton Hotel, Main Exhibit Floor, Booth 12.

Working together to bring people together  
**BELL TELEPHONE SYSTEM**



# NEW CLARK CONTROL CENTERS CAN SAVE YOU ONE VERTICAL SECTION FOR EVERY FIVE!

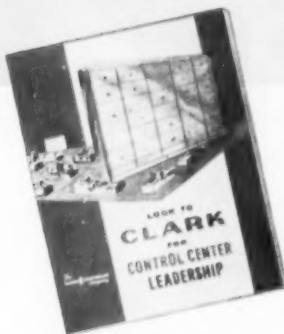


## features:

- SPACE SAVING
- SIMPLER MAINTENANCE
- GREATER VERSATILITY
- MAXIMUM SAFETY
- STRONGER and MORE RIGID

## plus!

• CLARK TYPE "CY" STARTERS,  
OF TIME PROVEN  
SUPERIORITY



WRITE for your copy of this informative book containing complete information for adapting the new CLARK space-saving CONTROL CENTERS to your needs.



and each section is only 20 inches wide!

You save space two ways with new CLARK Control Centers—vertical sections are only 20" wide, and each vertical section can house up to 6 size 1 or 2 non-reversing combination starters. Thus 30 starters can be accommodated in 5 sections—total width only 100 inches—compared with 6 sections of ordinary 5-unit design and considerably greater width. *Maintenance* is easier because all wiring and service—even bus replacement—is from the front or top. Parts

are standardized for greatest *versatility* and *flexibility*—making it simpler to adapt units to particular needs or alter arrangements after installation. For *maximum safety*, all bus is completely enclosed and empty compartments are protected by insulating barriers and closure panels. Heavy gauge steel plus exclusive design providing support for all load bearing members without dependence on shear strength of screws, assures added *strength* and *rigidity*.

*The* CLARK  
Everything Under Control



CONTROLLER *Company*

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IN CANADA: CANADIAN CONTROLLERS, LIMITED • MAIN OFFICES AND PLANT, TORONTO



**A FULL  
LINE  
OF  
QUALITY  
GROUNDING  
DEVICES  
BY**



**GROUNDING  
DEVICES  
WITH A  
TERRIFIC  
"QSP"  
RATING**

**QUALITY**  
tops  
**SERVICE**  
outstanding  
**PRICE**  
lowest



**RECEPTACLES**

**2514**  
PARALLEL SLOT SINGLE  
RECEPTACLE  
3 WIRE GROUNDING  
Wide Ears  
Double Contacts  
**15 Amp.—125 Volts**



**2524**  
TANDEM SLOT SINGLE  
RECEPTACLE—  
3 WIRE GROUNDING  
Wide Ears  
Double Contacts  
**15 Amp.—250 Volts**

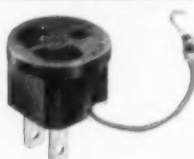


**2515**  
PARALLEL SLOT DUPLEX  
RECEPTACLE  
3 WIRE GROUNDING  
Wide Ears—Double Contacts  
**15 Amp.—125 Volts**



**2525**  
TANDEM SLOT DUPLEX  
RECEPTACLE  
3 WIRE GROUNDING  
Wide Ears—Double Contacts  
**15 Amp.—250 Volts**

All Items Available in Ivory — And All Receptacles Available on Box Covers



**ADAPTER**

**2573-L**  
3-WIRE BAKELITE  
GROUNDING ADAPTER  
Polarized Slots and  
"U" Shaped Grounding Slot  
3" Green Thermoplastic  
Grounding Lead.

Portable tools or appliances  
equipped with new type  
"grounding caps" may be  
quickly adapted to regular  
2-wire outlets with this  
new adapter.

**15 Amp.—125 Volts**



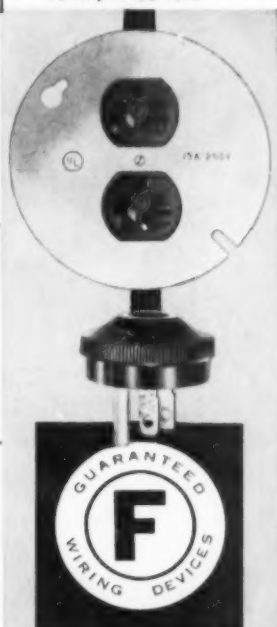
**3631**  
FOR DRYER AND POWER  
CORDS. 30 AMP. DRYER  
AND POWER RECEPTACLE  
Flush or Surface Mount  
Polarized with "L" Shaped  
Grounding Slot  
**30 Amp.—250 Volts**



**3651**  
FOR RANGE AND POWER  
CORDS. RANGE AND  
POWER RECEPTACLE  
Flush or Surface Mount  
Heavy Bakelite  
with Patented Swing-Away  
Terminals—Polarized  
**50 Amp.—250 Volts**



**3530**  
30 AMP. 3-WIRE DRYER  
AND POWER CORD SET  
One Piece Molded Rubber  
Cap—Includes Cable Clamp  
**30 Amp.—250 Volts**



**CIRCLE F MFG., CO., TRENTON 4, NEW JERSEY**



# Pringle

## "BOLTED" Pressure Silver Contact LOAD BREAK Service Entrance Switch

For over 60 years the first choice of electrical engineers and switchboard builders everywhere, *Pringle* Switches are expressly designed to fulfill the most exacting demands of transportation, communication, commerce and industry. In addition new and improved design features, assure you of unequaled trouble-free performance under the most grueling operating conditions.

- Interchangeable Fuse Terminals to accept :  
The Type XM Fuse (For use on 250 Volt Service only.)  
Bussmann Hi-Cap Type KRP  
Chase-Shawmut Amp-Trap Form 480 Type 55 H.
- Initial Pressure on Jaw contacts and new design improves Load Breaking ability.
- Special Arcing contacts (Renewable in sizes 3,000 amperes and larger) improves Load Breaking ability.
- Improved and stronger mechanisms.

*Pringle* Load Break "BOLTED" Pressure switches have established a new high in dependable uninterrupted service throughout their long life.

Yes . . . you can depend on a *Pringle*  
. . . *Pringle* has never sold a spare part.

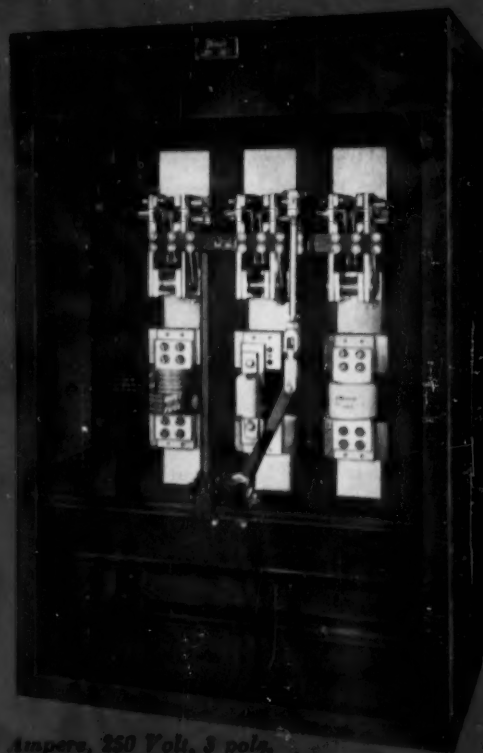
For further information and specifications to help you solve your power problems write to Dept. CM 41 for your free copy of Bulletin No. 1255.

*Pringle*

Since 1891

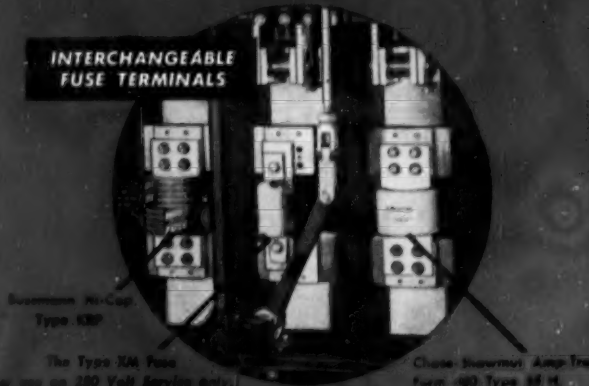
### ELECTRICAL MANUFACTURING COMPANY

serves  
transportation,  
communication,  
commerce,  
and industry.



3,000 Amperes, 250 Volt, 3 pole,  
enclosed Switch with cover removed.

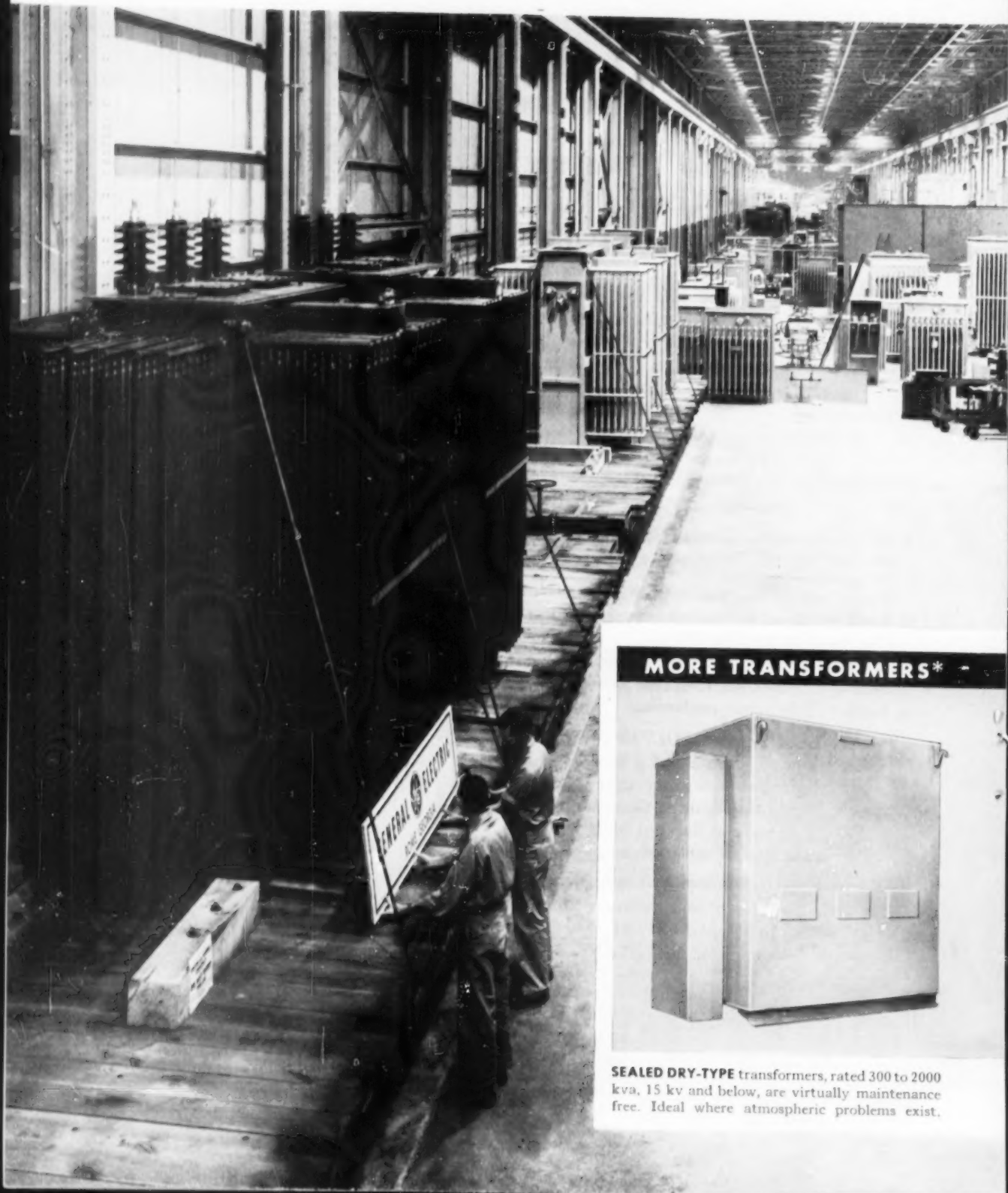
#### INTERCHANGEABLE FUSE TERMINALS



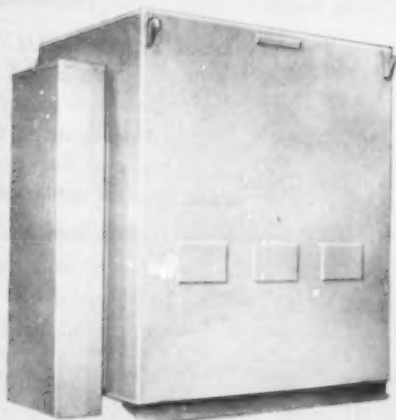
... tested by over sixty years of service . . .

1900-1912 NORTH SIXTH STREET  
PHILADELPHIA 22, PA.

# NOW...10-week shipment of



## MORE TRANSFORMERS\*



**SEALED DRY-TYPE** transformers, rated 300 to 2000 kva, 15 kv and below, are virtually maintenance free. Ideal where atmospheric problems exist.

# General Electric RM medium transformers

If your new or modernized plant power system calls for transformers 501 to 7500 kva, 69 kv and below, you'll benefit by faster shipment from General Electric. These RM medium transformers are currently being shipped in only 10 weeks from order date.

Standard-design transformers plus the General Electric repetitive manufacture process make possible this fast shipment. Standardization eliminates engineering and design time required for special units. Repetitive manufacture brings highly efficient production-line techniques to transformer production.

You benefit from standardization without sacrificing versatility. Voltage ratings and optional features are available for most industrial needs.

## **MORE RM MEDIUM TRANSFORMER BENEFITS:**

Faster delivery is only one of the outstanding benefits you'll receive. Here are more:

**Reduced maintenance, longer life**—control-center arrangement of indicators, full-drain feature, and many other features help minimize routine inspection time. Quality materials, plus continuous quality control during manufacture, assure greater reliability on the job.

**Faster, less expensive installation**—shipped completely assembled, RM medium transformers have features such as ski-tip bases, extra jacking space, and reversible junction boxes which can cut installation time to only four hours.

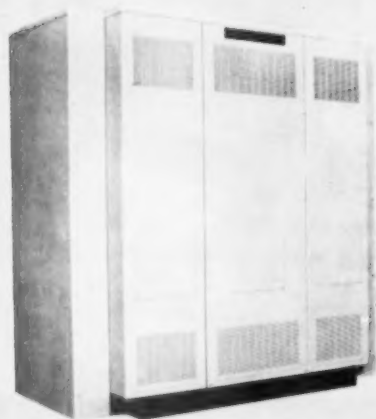
Before you buy a medium transformer, contact your nearest General Electric Apparatus Sales Office. You'll discover how faster shipment, easier installation, reduced maintenance, and longer life add up to more for your transformer dollar. General Electric Company, Schenectady 5, New York.

416-13

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

**FOR INDUSTRIAL USE FROM THE COMPLETE GENERAL ELECTRIC LINE**



**OPEN DRY-TYPE** transformers, rated 300 to 2000 kva, 15 kv and below, are used in clean, dry, indoor locations where weight or floor space problems exist. Light enough to mount overhead!

†Reg. Trade-mark of General Electric Co.



**LIQUID-FILLED** transformers, rated 112½ to 500 kva, 15 kv and below, conveniently and economically supply small blocks of power. Outdoor units are oil-filled; indoor, Pyranolt-filled.

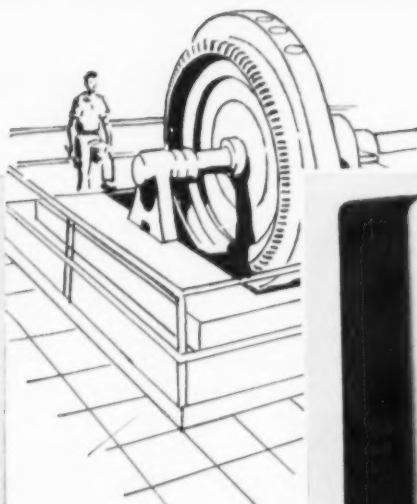
\*These same transformers are also incorporated in General Electric's outstanding line of load-center and distribution-center unit substations.



# THE TREND IS TO



**DC POWER FOR  
ELEVATORS**



**DC POWER FOR  
SYNCHRONOUS  
MOTOR EXCITATION**



**DC POWER FOR  
GENERAL  
SHOP USE**



**DC POWER FOR  
MAGNETIC DEVICES**



## WHERE GENERAL ELECTRIC SELENIUM RECTIFIERS

### ELEVATOR POWER SUPPLY

Commercial Buildings  
Cranes and Hoist Motors  
Shipyards

Foundries  
Railroad Shops  
Warehouses

### SYNCHRONOUS MOTOR EXCITATION

Compressors  
Pumps  
Motors

Fans  
Grinders  
Saws



# METALLIC RECTIFIERS

*When you need direct current—*

## General Electric Selenium Rectifiers Cost Less to Install, Operate, Maintain

Full line of units from 3/4 to 125 kw—with multiples for higher ratings

"The trend to metallic rectifiers" is based on economy.

Compared to other types of power-conversion equipment, General Electric selenium rectifiers: cost less to install (light weight, no heavy rotating parts, no need for special foundation); cost less to operate (over 80 per cent efficient from light load to full load); cost less to maintain (a small fan motor is the only moving part). They also save valuable floor space by providing, in one compact package, a complete power-conversion means—with no need for external accessories.

Whether you're considering a modernization program or simply need more spot d-c power, it will pay you to consider General Electric selenium rectifiers. Whatever your direct-current application—general shop power, elevator power supply, synchronous motor excitation, magnetic devices, etc.—there is a General Electric metallic rectifier designed and rated to do the job efficiently. General Electric offers a full line of selenium units from 3/4 kw to 125 kw (15 ratings in all), which may be paralleled for higher ratings. And for other specialized applications, General Electric offers the latest in germanium and silicon rectifiers.

If you would like to know more about how General Electric selenium rectifiers can supply dependable,

low-cost power for your direct-current operations, contact your nearest General Electric Apparatus Sales Office or write for bulletin GEA-6545 to Section 462-13, General Electric Company, Schenectady, N.Y.



Typical use of G-E selenium rectifiers is this 800-amp, 125-volt installation which supplies d-c power for elevators, fans, and air-conditioning units in a large building. The rectifiers replaced three turbine-generator sets, saving space and reducing maintenance.

*Progress Is Our Most Important Product*

GENERAL  ELECTRIC

**ARE SAVING MONEY IN INDUSTRY TODAY**

#### MAGNETIC DEVICES

Magnetic Arches

Magnetic Checks

Magnetic Clutches

Magnetic Pullers

Magnetic Separators

Solenoids

#### GENERAL DC POWER

Battery Charging and Farming

Machine Tools

Railroad Car Retarders

Arc Lights

Cable Drying

Test Power



# back of every RLM-Labeled Unit are 1,000 Words of Specifications

covering highest Industrial Lighting Standards in RLM History

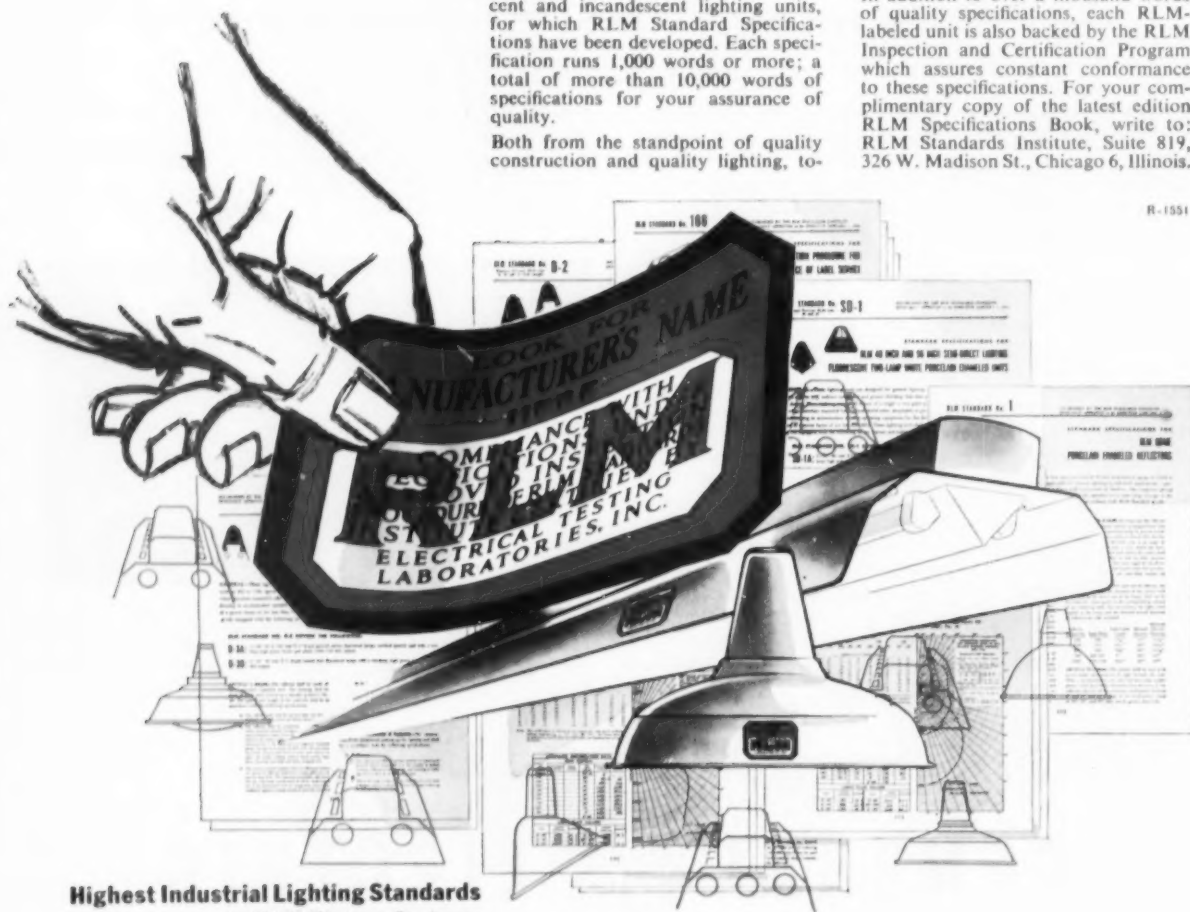
Back of every RLM-labeled lighting unit is the assurance of over a thousand words of quality specifications. Each word is in accord with the basic, nationally-accepted minimum standards for industrial lighting equipment efficiency, design and performance. In all, there are 10 types of industrial fluorescent and incandescent lighting units, for which RLM Standard Specifications have been developed. Each specification runs 1,000 words or more; a total of more than 10,000 words of specifications for your assurance of quality.

Both from the standpoint of quality construction and quality lighting, to-

day's RLM Specifications are the highest in history! The new RLM SD-1 standard, for example, calls for a fluorescent lighting unit with a 20% to 30% upward component to assure an important advancement in seeing comfort.

In addition to over a thousand words of quality specifications, each RLM-labeled unit is also backed by the RLM Inspection and Certification Program which assures constant conformance to these specifications. For your complimentary copy of the latest edition RLM Specifications Book, write to: RLM Standards Institute, Suite 819, 326 W. Madison St., Chicago 6, Illinois.

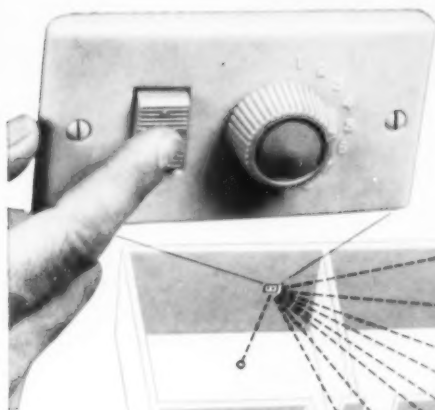
R-1551



## Highest Industrial Lighting Standards in RLM History feature:

- Higher light output • Lower-cost installation
- Better protection against glare
- More seeing comfort • Easier re-lamping
- Increased brightness control
- Reduction of light loss
- Safety from electrical hazards
- Protection against rust and corrosion





## One switch controls nine lights



# Remote-Control Wiring

**EASY AND PROFITABLE TO INSTALL . . .** General Electric remote-control wiring is one of the most effective sales features any new house can have — *and it's quick, simple, and inexpensive to install.*

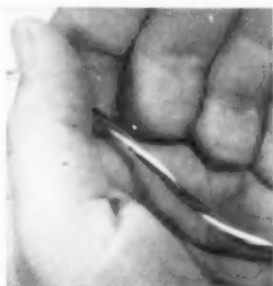
Lightweight, flexible wire is easy to work with . . . strips clean, can be stapled quickly yet securely to framing. All pigtails and wire leads are color-coded for positive identification to speed installation. Selector switches operate up to *nine* circuits in and around the home,

offering home buyers added safety, comfort, and step-saving convenience.

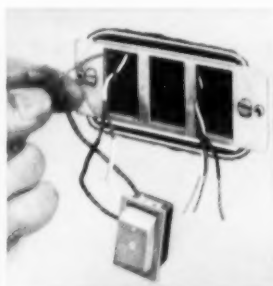
**FOR AS LITTLE AS \$35 PER HOUSE.** With all its advantages, G-E remote-control wiring is economical for homes in *any* price range. The complete installed cost is surprisingly low — averaging throughout the country only about \$35 to \$70 per house more than conventional wiring. It's a home-selling feature that means more wiring contracts, more profit for you.



**REMOTE-CONTROL RELAY** has a Nylon insulated, positive switching mechanism, heavy contact supports, rugged, riveted construction. Actuated by low-voltage current.



**LIGHTWEIGHT WIRE** used in the low-voltage circuits — is flexible, easy to work with, and strips clean. Is quickly stapled to framing.



**COLOR-CODED LEADS** mean less chance for error . . . make connection identification and installation of switches quick and easy.

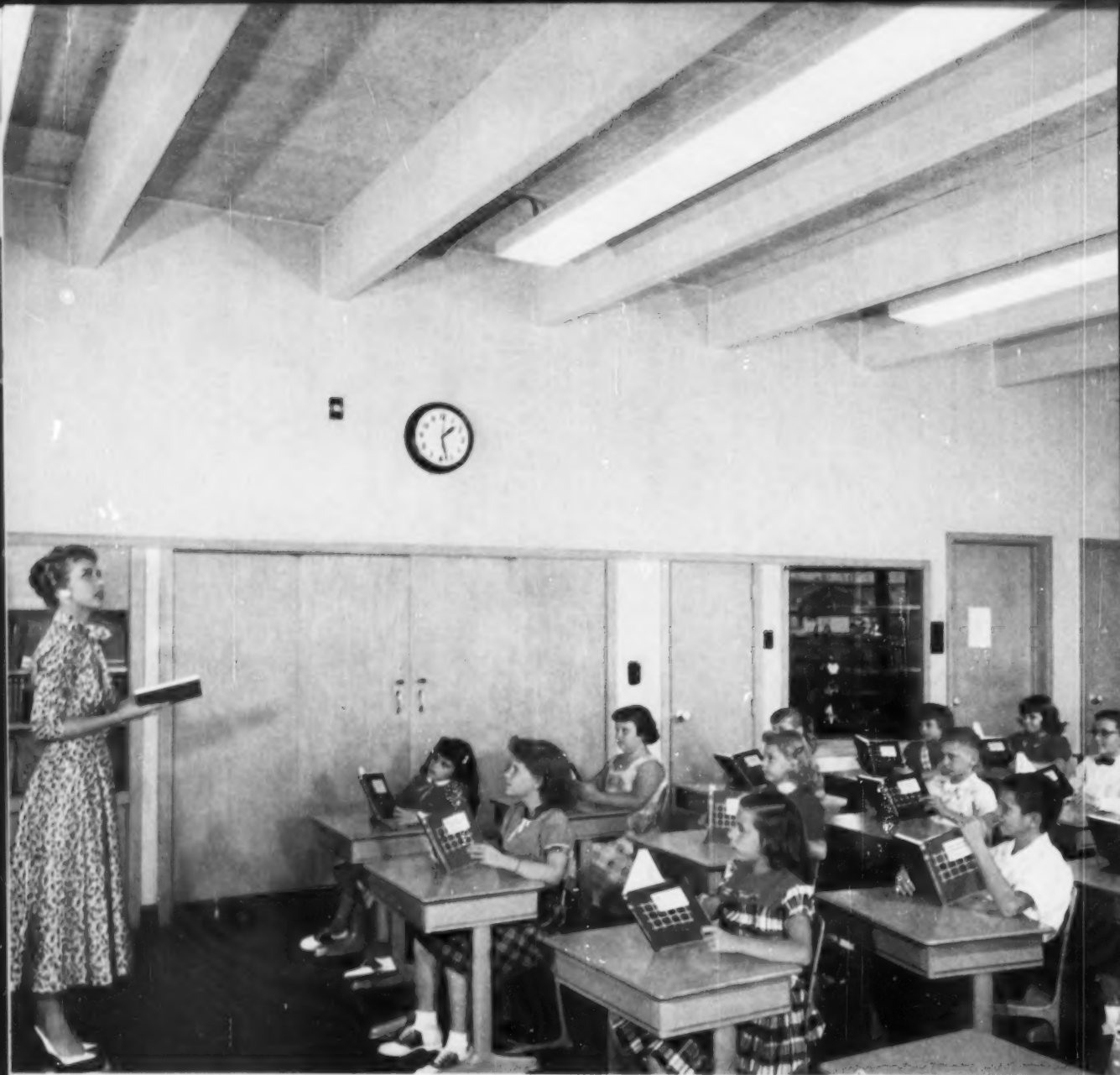


**G-E CONTRACTORS' MANUAL** shows you how to lay out, estimate, and install G-E remote-control wiring. Involves wire-saving and time-saving ideas to minimize installation costs.

For copies, write to Wiring Device Department, General Electric Company, Providence 7, R. I.

*Progress Is Our Most Important Product*

# GENERAL ELECTRIC



Fluorescent fixture noise is due to ballast noise, fixture amplification, type of ceiling, etc. G-E ballasts are designed to operate quietly and give you a "Sound Rated" installation every time.



G.E. has designed a three-piece core assembly with push-on clamps. All air gaps are cemented and special coil wedges reduce vibration in the core and coil assembly. A special potting compound aids in noise reduction.



G.E.'s new sound laboratory pays off in quieter ballasts for you. Sound engineers test every new design and spot check production models in an attempt to find new methods and materials to give you a quieter ballast.

# Adequate light, yes—But WHAT'S THAT HUMMING?

Many fluorescent lighting installations are furnishing the specified light, but they are also furnishing an unspecified distraction—noise.

Every ballast has a normal magnetic hum. However, the intensity of the humming in fixtures is not only dependent upon such factors as basic ballast construction and the ballast rating, but fixture construction and installation can also contribute to a large extent to noise amplification. And because of these variable factors, fluorescent lighting installations can range all the way from silent to noisy and annoying.

General Electric's new, exclusive Sound Rating Calculator now makes it possible for specifiers of fluorescent lighting installations to determine beforehand whether or not they will encounter a ballast noise problem.

It's done this way: The average sound level of every General Electric ballast

currently listed has been measured. This measurement is called the sound rating and is stamped on each ballast case. By knowing this rating, the number of ballasts in the installation, the size and acoustical characteristics of the room, and the ambient sound level you can determine whether or not you will have a sound problem. All you have to do is set up the information in the calculator wheels. It's as simple as that. See how to get your copy of the G-E Sound Rating Calculator below.

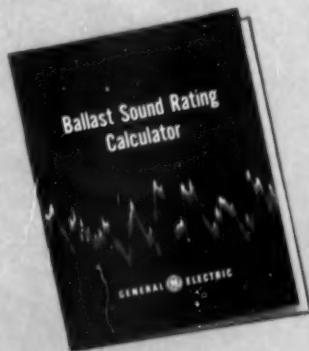
Make certain you take advantage of this new development from General Electric while current projects are in the planning stages. Send for the Ballast Sound Rating Calculator and be sure of a General Electric "Sound-Rated" installation every time. And for additional assistance, contact your local General Electric Apparatus Sales Office—because when it comes to ballasts, it *pays* to specify General Electric sound-rated ballasts.

*Progress Is Our Most Important Product*

GENERAL  ELECTRIC



On the spot application engineering assistance is also available. Nearly 100 ballast application engineers located throughout the United States stand ready to assist you. They are as close to you as your telephone.



## SEND FOR YOUR SOUND RATING CALCULATOR

Send check for one dollar with your name and address to:  
**General Electric Company,  
Section C401-31, Schenectady  
5, N. Y. Your Sound Rating  
Calculator will be sent to you  
by return mail.**

# The shape of fluorescent lamps to come



## New General Electric "Power-Groove" discovery means more light for you . . . at less cost

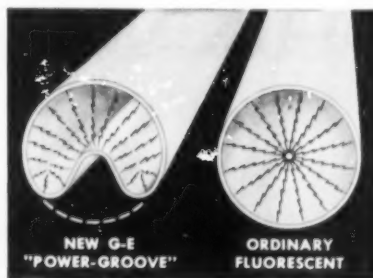
Look at this new kind of fluorescent lamp. It's the General Electric "Power-Groove"—a revolutionary new development created by G-E engineers. It not only gives more than  $2\frac{1}{2}$  times as much light as the 8-foot slimline (most widely used 8-foot fluorescent), and lets you save more than 20% on your initial cost, and has fewer parts to maintain . . . but it even *looks* different—for a reason.

*It's the grooves in General Electric "Power-Groove" Lamps that make possible a greater increase in light-per foot than all the combined increases made since General Electric introduced fluorescents in 1938!*

The new G-E "Power-Groove" Lamps are the popular 8-foot length (200-watts) with 4-foot sizes also available and 6-foot sizes later. They are Rapid Start lamps that need no starters—and are to be used in fixtures and circuits designed especially for them.

**IF YOU'RE PLANNING** a new lighting installation—you'll want to investigate G-E "Power-Groove". New G-E "Power-Groove" lamps are going into some installations right now! You'll be able to buy them . . . and the fixtures . . . in quantity by midsummer, so get the whole story now. Call your local G-E Lamp Supplier or write: General Electric Co., Large Lamp Dept., Nela Park, Cleveland 12, Ohio.

**COMPARE!** The new G-E "Power-Groove" construction (left) works 3 ways to give more light. One: it places some of the light-producing phosphors closer to the energizing area in the center of the lamp. Two: it presents a greater surface area which permits the generation of more ultraviolet rays to activate the phosphor. And three: it makes the lamp run cooler—which permits a higher current design and gives you more light per watt.



*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**





## Now . . . CHASE takes the wraps off the greatest tape saver in years!

**New Saran Wrap\* packaging prevents costly storage losses . . . keeps every roll "factory fresh"**

**CHECK THESE ADVANTAGES** and see for yourself why Chase's revolutionary new moisture-proof packaging assures top taping qualities in every roll of Chase Electrical Tape you buy.

**SEALED-IN FRESHNESS!** Because it has the lowest moisture vapor transmission rate of any transparent packaging material, Saran Wrap actually *seals out* harmful moisture . . . *seals in* factory freshness. Saran Wrap's superior packaging characteristics also help prevent peeling, drying out or raveling . . . assures lasting tack in roll after roll.

**MAXIMUM PROTECTION!** Tough, transparent Saran Wrap molds itself to each roll to form a neat, weather-resistant package . . . protects Chase Tapes against dust, dirt and drying out in between jobs.

**LONGER STORAGE LIFE!** Fresher, *longer-lasting*, Chase Saran-Wrapped Tapes eliminate troublesome storage problems . . . permit adequate stocking to meet both immediate and long range requirements.

**Try several rolls** of Chase Saran-Wrapped Tape now! Order through your distributor or write us for complete details. Chase & Sons, Inc., 26 Spruce Street, North Quincy, Massachusetts.

\*Trademark of the Dow Chemical Company for its vinylidene chloride copolymer film.

# CHASE & SONS INC.

North Quincy • Massachusetts

CABLE INSULATING TAPE • CABLE BINDING TAPE  
CABLE JACKET TAPE • NEOPRENE SPLICING TAPE  
FRICTION, RUBBER & PLASTIC TAPE  
LAMINATED & REINFORCED INSULATION

# \*"TOUGH" conduit coupling jobs

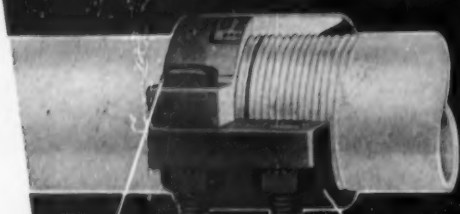


(Type "SP")

Interior thread meshes with conduit threading for rigid, tight-fitting connection.

are easy with O.Z.

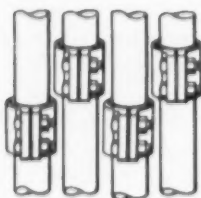
split couplings



Bolt heads are held in place by shoulder on coupling, eliminating need for second tool.

One piece malleable iron construction facilitates handling during installation.

To install, simply slip over one conduit end, butt ends of both conduits, slide fitting back into position and tighten nuts.



\* "Tough"—(Where ordinary couplings can't be installed). Are clearances close—near floor, wall, ceiling or other obstructions? Can conduits be turned due to bends? Is space or accessibility a factor? Just install an O.Z. Type "SP" Split Coupling.

Butt the conduit ends within the O.Z. Split Coupling—tighten two nuts with an ordinary open-end wrench and presto . . . you have a permanent, close-fitting, rigid connection.

Drastically reduced installation costs, plus initial savings of as much as 50% in larger sizes, over similar competitive fittings, are just two of the many reasons why you should specify O.Z. Split Couplings for your difficult conduit coupling jobs.

Call your local O.Z. distributor . . . he is ready to make immediate delivery from stock on sizes from 1/2" to 5".



## O.Z.

ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • Esterbrook 9-0326  
Office and Factory: 749 Bryant Street, San Francisco 7, Calif. • GARfield 1-7846

CAST IRON BOXES  
CABLE TERMINATORS  
POWER CONNECTORS  
SOLDERLESS CONNECTORS  
GROUNDING DEVICES  
CONDUIT FITTINGS

*Wherever quiet is essential...*

## THE LEVITON QUIET SWITCH

DOES NOT DISTURB

For bedrooms, sickrooms, nurseries, libraries, hotels, hospitals and other places where "peace and quiet" are essential... the Leviton Quiet Switch is just what is needed.

A lifetime switch that is tops for quality, reasonable in price and up-to-date in quiet action. Everyone is switching to Leviton Quiet Switches... the modern switch for homes, institutions and industry.

**MECHANICAL QUIET SWITCH** Fully enclosed. Operates in any position. Will withstand the high inductive loads of fluorescent systems and take the full rated capacity of tungsten filament lamp loads. Rated 15A, 120-277V. AC only. This new 277 volt rating permits this switch to be utilized in modern 4-wire electrical systems now being installed.

#5501—Single Pole; #5502—Double Pole; #5503 — 3-Way, all with brown or ivory toggle

### ALSO AVAILABLE: QUIET SWITCH FOR HEAVY-DUTY USE

Fully enclosed. Rated 20A, 120-277V. AC only with red cover.

#5521—Single Pole... #5523—3-Way, both with brown or ivory toggle.

Write for descriptive literature. All quiet switches Rated by U.L. and C.S.A.

*your best jobs are done with...*

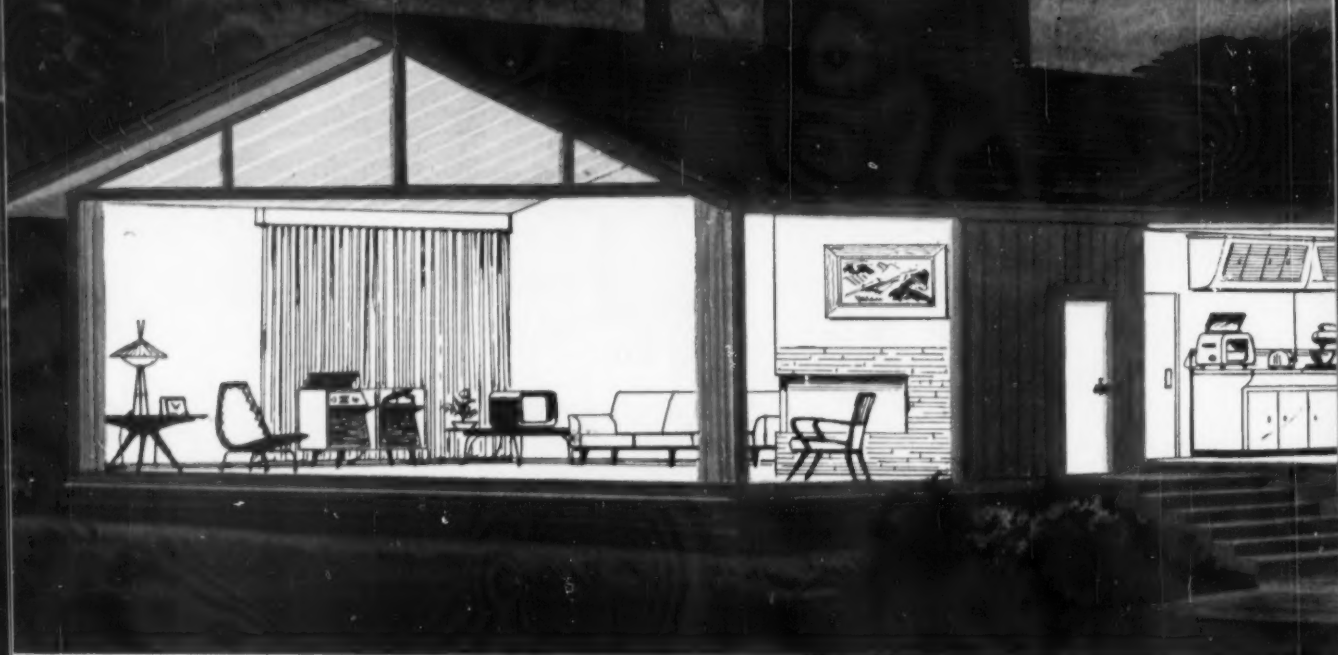
LEVITON MANUFACTURING CO., INC., BROOKLYN 23, N. Y.

Chicago, Los Angeles, Leviton (Canada) Limited, Montreal

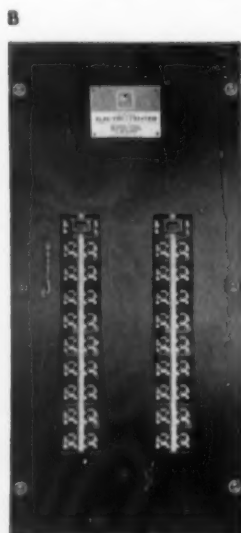
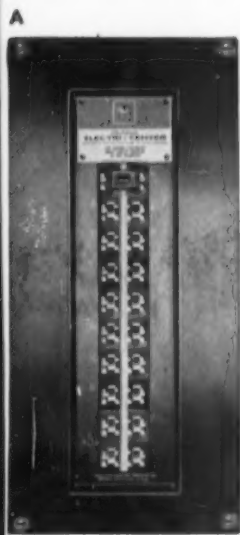
For your wire needs, contact our subsidiary, AMERICAN INSULATED WIRE CORPORATION

**LEVITON**





## Now! Over-all electrical protection—one main



**A.** Single-row panels feature one factory-installed main disconnect... are available in capacities of 70 or 100 amps with space for 12 or 18 circuits.

**B.** Double-row panels feature two factory-installed 70- or 100-amp main disconnects for 140 or 200 amps capacity ... with space for 24 or 36 circuits.

**C.** Separate 70- or 100-amp enclosed Pushmatic main disconnects are used when the branch-circuit panel is located at any distance from the service entrance. (Figure "C" shown blown up for clarity.)





## disconnect for every 100 amps of service

### New 70- and 100-amp Pushmatics bring Safer Electrical Living!

It's here . . . maximum protection for service entrance conductors! . . .  
maximum protection for all branch circuit wiring! . . . maximum protection  
for lamp and appliance cords!

This over-all protection for everything electrical in the home is made  
possible and practical with the new 70- and 100-amp Pushmatic circuit  
breakers. Here's why:

The new main disconnect breakers for every 100 amps of service prevent  
overloading of service conductors. The thermal bi-metal operation of  
Duo-Guard Pushmatics® prevents overloading of branch circuit wiring.  
The exclusive solenoid-magnetic operation of Pushmatics gives maximum  
protection against short circuits caused by faulty cords. Offer all this—  
plus push-button convenience. See your electrical distributor. © BEPCO

Bulldog Electric Products Company, Detroit 32, Michigan • A Division of I-T-E Circuit  
Breaker Company • Export Division: 13 East 40th St., New York 16, N.Y. In Canada:  
Bulldog Electric Products Co. (Canada), Limited, 80 Clayson Rd., Toronto 15, Ontario.



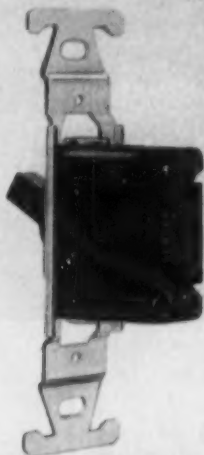
IF IT'S NEW . . . IF IT'S DIFFERENT . . . IF IT'S BETTER . . . IT'S

**BULLDOG**  
ELECTRIC PRODUCTS COMPANY

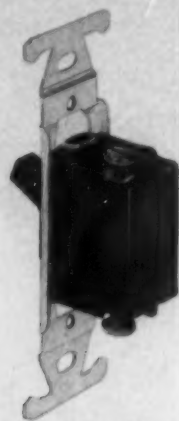
# QUIET *as a...*



15 AMP — 120 VOLTS — 277 VOLTS  
AC ONLY

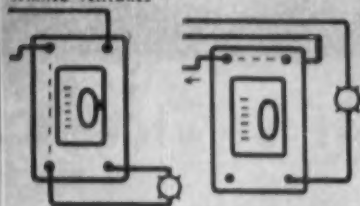


20 AMP — 120 VOLTS — 277 VOLTS  
AC ONLY



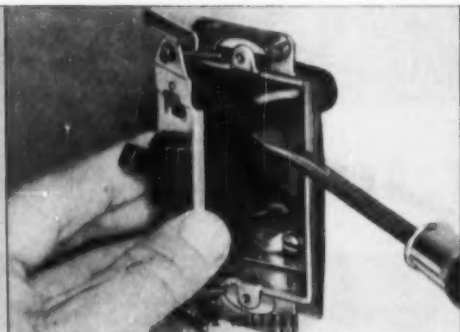
## NEW! SLATER A.C. QUIET SWITCHES

### WIRING FEATURES



THRU-WIRE SYSTEM  
CATALOG NO. 601

LINE SHUNT  
CATALOG NO. 605



### LOADED WITH FEATURES

- NEW TYPE, "PLUS" SERVICE, SILVER CONTACTS
- THRU-WIRE SYSTEM OR BUILT-IN SHUNT
- "SPEEDWIRE" REAR WIRING OR SCREW TERMINALS
- EXCLUSIVE SIDE RELEASE; (Patented)
- OPERATES IN ANY POSITION
- EXTRA NEOPRENE BUMPERS FOR SILENCE

**EASY** to install • **SIMPLE** to remove • **NO** call backs

Available in single pole, double pole, 3-way and 4-way with ivory or brown feather-touch toggle, Slater's brand new line of ultra reliable quiet switches provide smooth, noiseless operation. Rated 15 amperes, 120 and 277 volts and 20 amperes, 120 and 277 volts. Slater quiet switches are made to serve your job re-

quirements with perfect performance.

Slater A.C. Quiet Switches are easy to install. Next time save time, money and effort. Ask your electrical wholesaler for Slater Quiet switches with "speed wire" rear wiring and exclusive side release feature or with screw terminals.



SEND FOR  
CATALOG #35

SAY  
SLATER  
WITH  
CONFIDENCE

**Slater**  
Lifetime Wiring Devices

SLATER ELECTRIC & MANUFACTURING CO., INC. GLEN COVE, NEW YORK.

For top value . . . in any type . . . get JENKINS

# Gold Seal Tape

**FRICTION • RUBBER • PLASTIC**



**ELASTIC—  
MOLDS TO SHAPE**

**RESISTS  
SUNLIGHT  
AND WEATHER**



**STICKS ON—  
STAYS ON  
NEAT, THIN  
WRAPPING  
FULLY  
INSULATES**



**CELLOPHANE  
PROTECTED**



## ◀ BEST BUY FOR PLANT SUPPLY

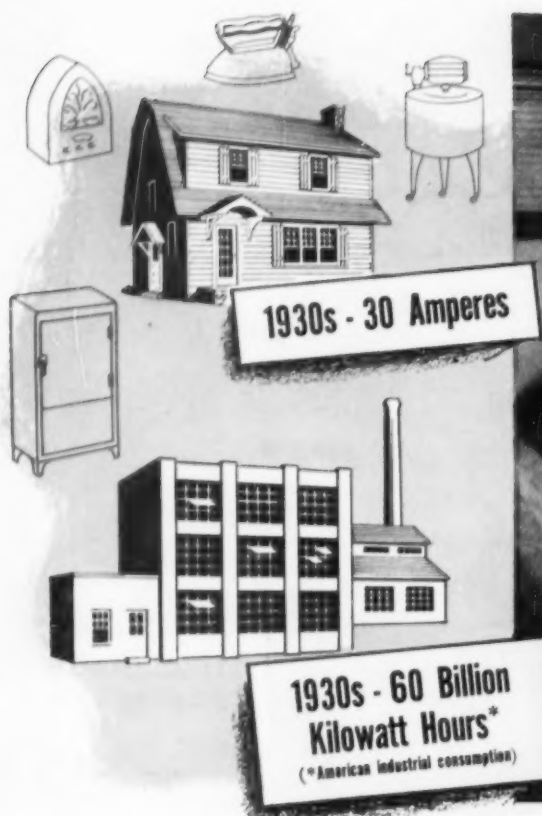


All types of **GOLD SEAL TAPE** — Friction, Rubber, Plastic — are packed in 10-roll cartons as well as single rolls. Every roll cellophane-protected, stays fresh. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

**DIAMOND SEAL**  
Friction and Rubber Tapes are also made by Jenkins Bros. to ASTM Specifications.

**DEFIES WATER,  
OIL, SOLVENTS**





## YOU'RE "WIRED" FOR GR

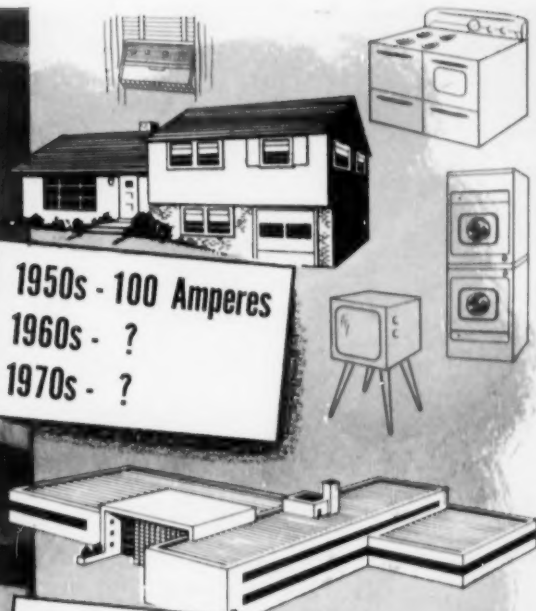
### the latest and best in adequate wiring for industry and home!

**PLAN FOR THE FUTURE**—This is a time to look ahead and specify electrical wiring that will be safe and adequate under increasing power loads . . . a time to get "wired" for growth with **Hatfield!**

**YOU CAN ALWAYS COUNT** on Hatfield for electrical wire and cable that will meet or exceed the highest specifications. Hatfield is a pacesetter in wire research and manufacturing . . . uses precision methods with automatic controls that insure undeviating quality.

**FOR THE BEST DEAL IN CARTON, COIL OR REEL . . .  
SPECIFY HATFIELD!**





1950s - 100 Amperes  
1960s - ?  
1970s - ?

1950s - 250 Billion  
Kilowatt Hours\*  
(\* American industrial consumption)  
1960s - ? 1970 - ?

## OWTH WITH HATFIELD!

### NEW, UP-TO-THE-MINUTE SPECIFICATIONS BOOKLETS

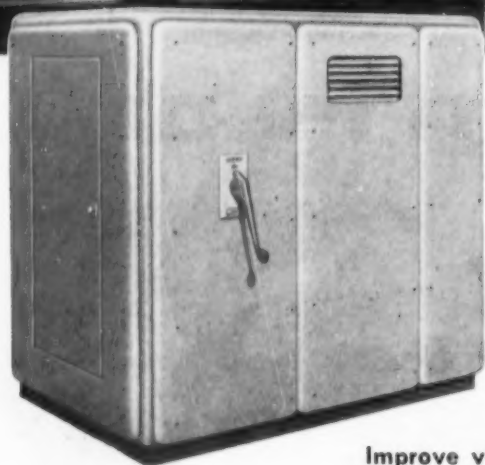
Get your free copies of Hatfield's new specifications booklets: "RR Cable"—"Control Cable"—"Building Wire." Write today!



**HATFIELD WIRE & CABLE**

DIVISION OF CONTINENTAL COPPER & STEEL INDUSTRIES, INC.

EXECUTIVE OFFICES: HILLSIDE, NEW JERSEY



## **new ideas in lighting ...protected with modern Kuhlman power centers**

**Improve voltage regulation . . . reduce power losses and line drops . . . increase modern lighting efficiency**

Installation of new, highly efficient lighting systems are performance-protected when modern KUHLMAN power centers are used. These completely self-contained, compact, attractive indoor power centers, 300 KVA and below, are ideal for smaller building primary lighting. Ask your local, friendly KUHLMAN representative, or write for the new reference bulletin CS-1010 giving all the facts on KUHLMAN load center transformers.

577

# **KUHLMAN** ELECTRIC COMPANY

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

# GEDNEY'S RIGHT THERE IN YOUR CORNER

*helping save time . . . hold down costs*

CORNER FITTINGS? Well, here are three that have proved immensely popular for the simple reason they're easiest to install—save time and labor that really counts up. Like the

rest of the full Gedney line they're made of unbreakable malleable iron...accurately machined and threaded...individually inspected. Order Gedney—always—for lowest installed costs!

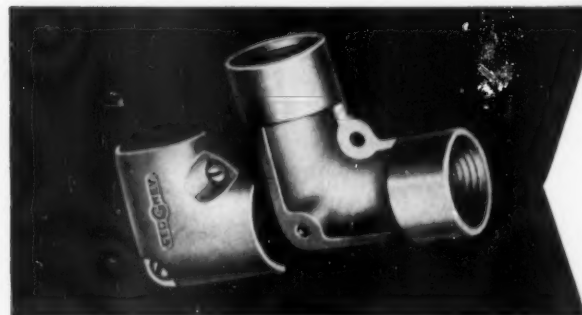


## 90° CORNER ELLS

Fitted with gasketed cover. Both ends female. Made of malleable iron, cadmium plated. Available in a full range of sizes from 1/2" to 2".

## 90° CORNER ADAPTERS

Fitted with gasketed cover. One end male, one end female. Made of malleable iron, cadmium plated. Your choice of sizes from 1/2" to 2".



## CORNER PULL-IN CONDUIT ELLS

Today's top specification for space-saving, machine wiring, easy wire pulling. Malleable iron, cadmium plated. Sizes run from 1/2" to 2".



**GEDNEY FITTINGS FIT**

**GEDNEY**  
ELECTRIC COMPANY



RKO BLDG. • RADIO CITY • NEW YORK 20  
Foundry, Factory and Shipping Point: Terryville, Conn.

# "Heating in our switch was causing 'lights-out' shutdowns until we changed to cooler operating Fusetron Fuses"

*Thomas Lavin, Building Engineer  
Railway Exchange Building  
Denver, Colorado*



## *Mr. Lavin Continues:*

"We had considerable trouble with heat developing in a lighting switch and causing fuse blows. It was very annoying having the lights go out so often—and having regular maintenance work interrupted to replace fuses.

"Checking with an ammeter we found the continued load to be 28 ampere. This indicated that 30 ampere fuses in use were the right size for safe protection. Nevertheless, the renewable fuses we had installed kept blowing.

"Evidently, what we needed were the same size fuses that would operate cooler to eliminate heating in the switch.

"At the suggestion of a salesman we tried 30 ampere Fusetron dual-element fuses. Our heating problem immediately disappeared. This was 7 or 8 months ago and we have had no trouble with the switch overheating—and our—'lights-out' shutdowns are a thing of the past."



## Here's why Fusetron Fuses protect against needless blows caused by excessive heating of panels and switches

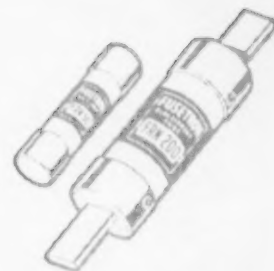
Fuses, like other protective devices operate from heat created by the current flowing through them. Thus they produce some heat even in normal operation.

Sometimes the heat is not dissipated from switches and panels fast enough. This piled up heat over-heats fuses and reduces their carrying capacity. Then fuses often blow even though not loaded to their rated capacity.

A logical answer to this heating problem is the use of Fusetron fuses. Fusetron fuses produce less heat

because they have less electrical resistance than ordinary fuses. For example, ordinary fuses have 55 to 117% greater resistance than Fusetron fuses in 250 volt sizes and up to 140% greater resistance for 600 volt sizes.

Since the lower resistance of Fusetron dual-element fuses means less generation of heat, switches and panels operate much cooler. This materially reduces or wipes out entirely useless shutdowns caused by fuses blowing due to overheating of panels and switches.



*Save time, trouble and money by using Fusetron dual-element Fuses.*

### THEY PROVIDE 10 POINT PROTECTION

- 1 High interrupting capacity—protect against heaviest short circuits. Have proven on tests to open safely on circuits set to deliver in excess of 100,000 amperes.
- 2 Protect against needless blows caused by excessive heating—less resistance results in cooler operation.
- 3 Protect against needless blows caused by harmless overloads.
- 4 Provide thermal protection—for panels and switches against damage from heating due to poor contact.
- 5 Protect against waste of space and money—permit use of proper size switches and panels.
- 6 Protect motors against burnout from overloads.
- 7 Give DOUBLE burnout protection to large motors—without extra cost.
- 8 Protect motors against burnout due to single phasing.
- 9 Make protection of small motors simple and inexpensive.
- 10 Protect coils, transformers and solenoids against burnout.

*Write for bulletin FIS.*

### FOR LOADS ABOVE 600 AND UP TO 3000 AMPS. — USE BUSS HI-CAP FUSES!

They have an interrupting capacity sufficient to handle any fault current regardless of system growth.

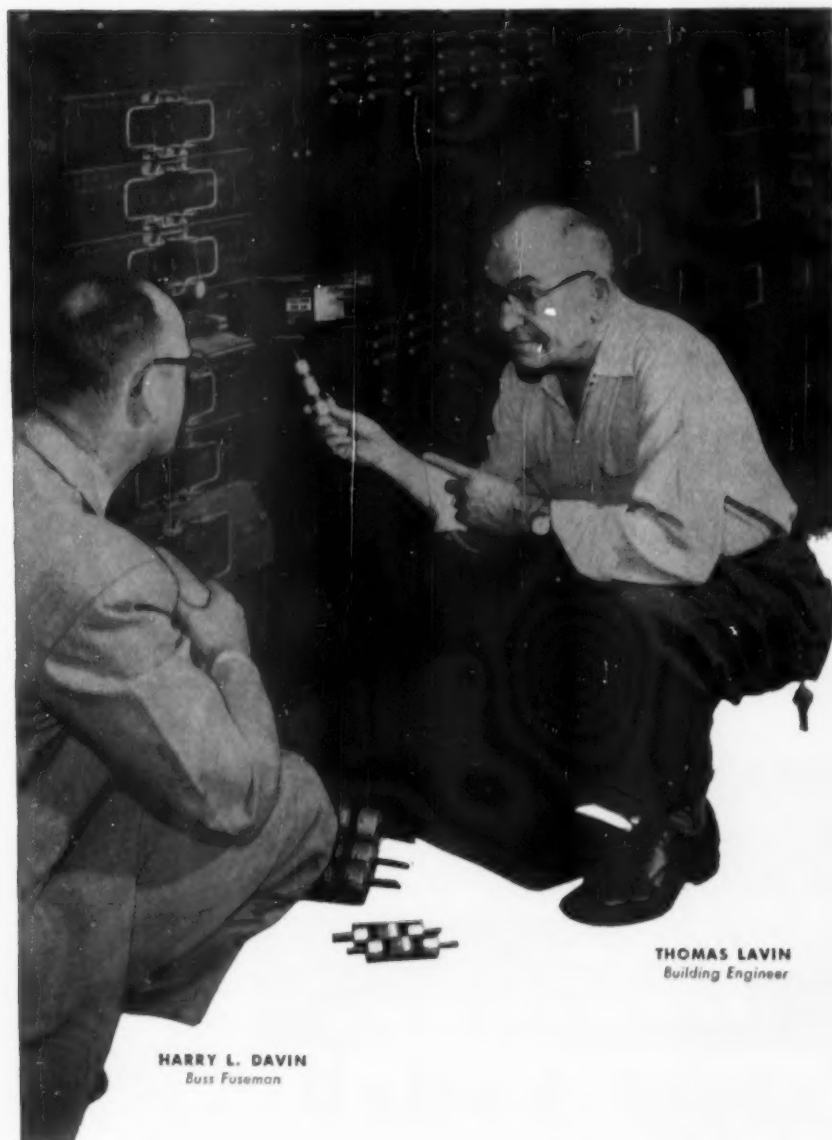
They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuit of origin.



*Write for bulletin HCS.*

**Play Safe!** install FUSETRON dual-element Fuses and BUSS Hi-Cap Fuses throughout entire Electrical System!

**BUSSMANN MFG. CO.**  
(Div. of McGraw Electric Co.)  
University at Jefferson,  
St. Louis 7, Mo.



**HARRY L. DAVIN**  
Buss Fuseman

**THOMAS LAVIN**  
Building Engineer



## Look what happens when you specify **BENJAMIN** Troffer Lighting

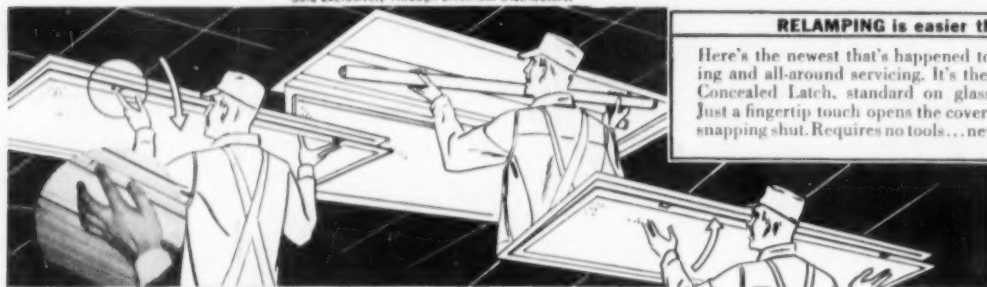
Things really start to happen when you specify money-saving, new Benjamin Troffers. Lighting maintenance expense is cut. Low-ceilinged rooms get a new improved light treatment. Annoying glare is banished. There's a brand new freedom of architectural expression and lighting layout. Shown here are a few of the advanced Benjamin features that help to make all this happen at the lowest possible cost per year. Investigate Benjamin Troffer Lighting for schools, stores, offices and factories . . . all things considered they're the Better Lighting Choice.

BENJAMIN ELECTRIC MFG. CO., DES PLAINES, ILLINOIS  
Sold Exclusively Through Electrical Distributors.



**APPEARANCE is better than ever!**

Greater ceiling beauty can happen to any room with the slim, trim design of Benjamin Troffers. A seamless frame, which shows no visible marks where the cover is joined, and concealed latches and hinges, make possible smooth, uninterrupted lines.



**TROFFER SELECTION is greater than ever!**

There's no need to compromise size, style or type of installation when you specify Benjamin Troffers! Any architectural effect you desire can be made to happen with this wide

choice; 12" and 24" widths; 4' and 8' lengths; 2' x 2' for fill-ins; wide range of glass and plastic covers or louvers; six different mounting styles.

**RELAMPING is easier than ever!**

Here's the newest that's happened to speed up relamping and all-around servicing. It's the Benjamin DeLuxe Concealed Latch, standard on glass-enclosed troffers. Just a fingertip touch opens the cover . . . closes by simply snapping shut. Requires no tools . . . never needs servicing.

14078





## LAYTEX® ROYAL MASTER PORTABLE ELECTRICAL CORDS

Continuous movement of this automotive assembly line requires work stations serviced by men using power tools attached to more than 50,000 feet of U. S. Laytex Royal Master Portable Cords. The tools include screw drivers, grinders, polishers, discing tools, drills, and spot welders weighing up to 25 lbs.

The U. S. Portable Cord on each tool is always under strain, either from supporting the tools when not in use, or from tugging by the worker as he follows the moving car on the assembly line.

And the U. S. Cords in grinders are attacked by particles of lead, iron and other metal as they fly through the air. Cords on grinders and finishers are dragged across unfinished bodies, sharp openings

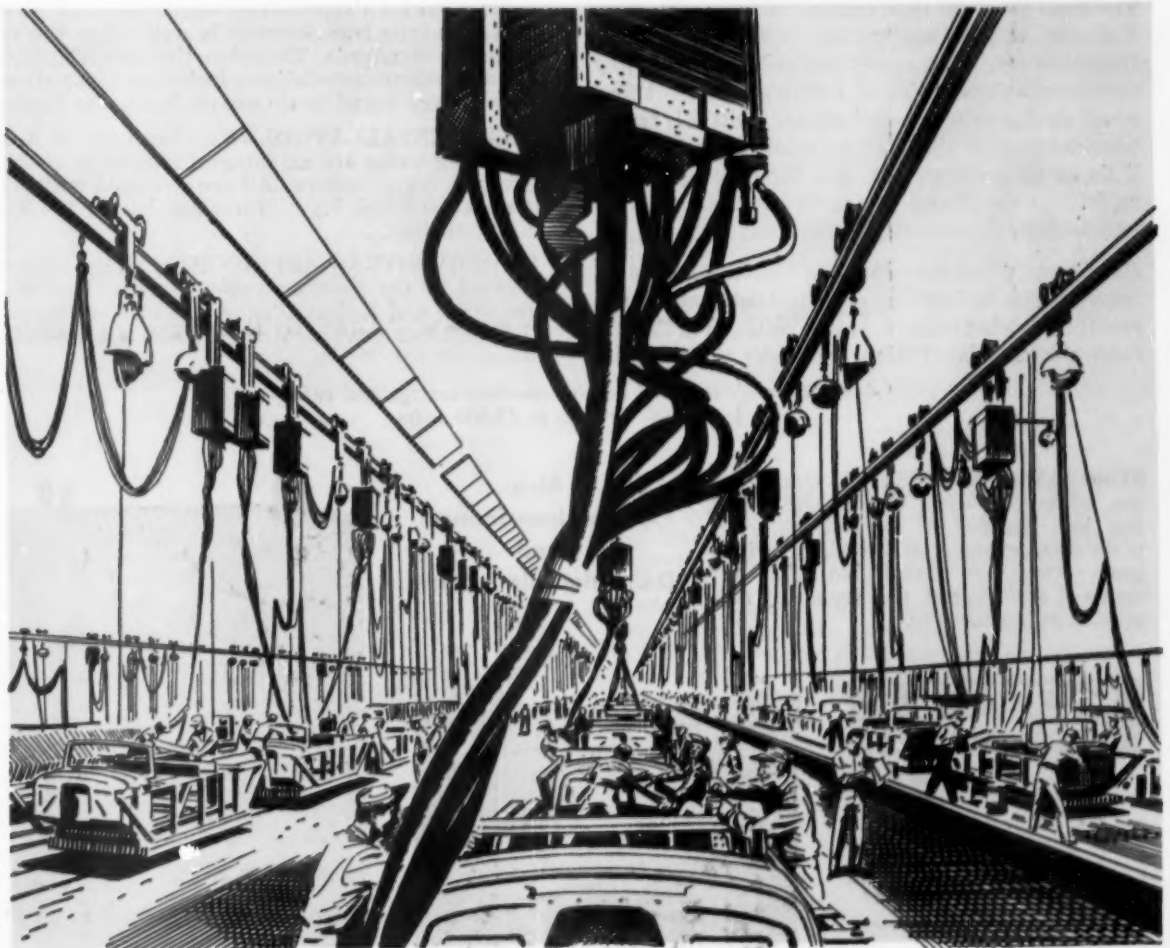
and edges. Car doors are often slammed on them; they are often hit by hammers.

"NONE OF THE OTHER TYPES OF CORD WE TRIED LASTED OVER A MONTH. U. S. LAYTEX ROYAL MASTER PORTABLE CORDS LAST FROM 5 TO OVER 10 TIMES AS LONG. THAT'S WHY WE HAVE STANDARDIZED ON THEM," says the plant engineer.

U. S. Laytex Royal Master Portable Cords are obtainable at your "U. S." branch, your distributor, or write Electrical Wire & Cable Department, United States Rubber Company, Rockefeller Center, New York 20, N. Y.

**"U. S. Laytex Royal Master Cords last 5 to 10 times longer than any we've used,"**

**says plant engineer of automotive manufacturer**



Electrical Wire & Cable Department

# United States Rubber

# For more economical operation

## Modernize

### electric distribution systems with **SORGEL** air-cooled transformers or substations

**INCREASE FEEDER CAPACITY AND EFFICIENCY BY  
TRANSMITTING ELECTRIC POWER AT HIGHER VOLTAGES TO LOAD CENTERS**

The most practical type transformers to step down Voltages at load centers are SORGEL dry-type transformers. They can be installed in almost any convenient place inside of buildings, without fire-proof vaults or other enclosures. SORGEL transformers are of the highest quality, and require little or no maintenance. No liquid to check nor replenish; small and compact; easy and convenient to install; economical operation.

**Increased efficiency**—Because SORGEL transformers can be installed close to load centers, the result is shorter feeders, better voltage regulation, more efficient distribution, and lower wiring cost.

**QUIET OPERATION**—The sound level of SORGEL dry-type transformers is well below the established standards. Therefore they are adaptable for any indoor installations, including those structures where sound levels are an important factor.

**EASY INSTALLATION**—Wall brackets or floor mounting bases are an integral part of SORGEL dry-type transformers. All are equipped with solderless terminal lugs. Terminal board for the larger ratings.

**UNDERWRITERS' APPROVED** in all the ratings covered by the Re-examination Service, both single phase and 3-phase. They also meet or exceed the requirements of ASA, AIEE, and NEMA standards.

*Available in all standard and intermediate ratings and voltages  
1 to 3000 Kva up to 15,000 volts.*

**SUBSTATIONS**—SORGEL transformers, either dry-type or Askarel-cooled, are incorporated in substations, complete with primary or secondary switchgear. They are procurable with any make of switchgear, and from any substation manufacturer.

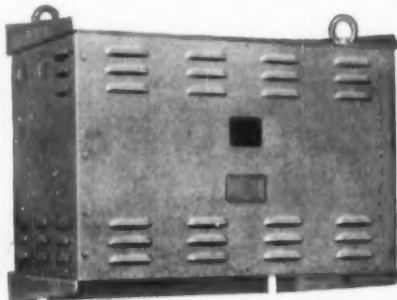
Also  
special transformers  
and  
D.C. saturable reactors

**SORGEL  
TRANSFORMERS**

Stock carried by jobbers in  
the following cities:

New York, N. Y.	Chicago, Ill.
Buffalo, N. Y.	Rock Island, Ill.
Roxbury, Mass.	Rockford, Ill.
High Point, N. C.	Richmond, Ind.
Raleigh, N. C.	Cedar Rapids, Iowa
Philadelphia, Pa.	Davenport, Iowa
Cincinnati, Ohio	Omaha, Neb.
Cleveland, Ohio	Beaumont, Texas
Louisville, Ky.	Los Angeles, Calif.
San Francisco, Calif.	

Consult the classified section of your  
phone directory or write to factory



15 to 50 kva 3-phase. Wall mounting type

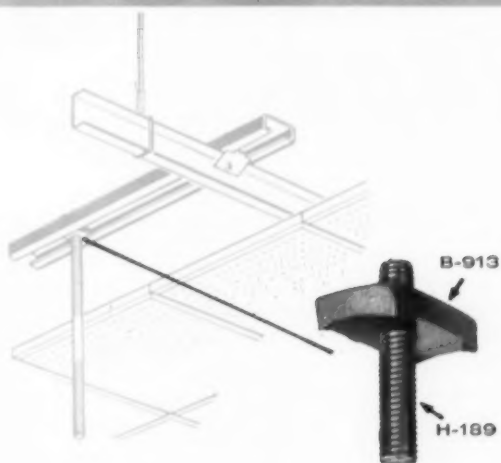
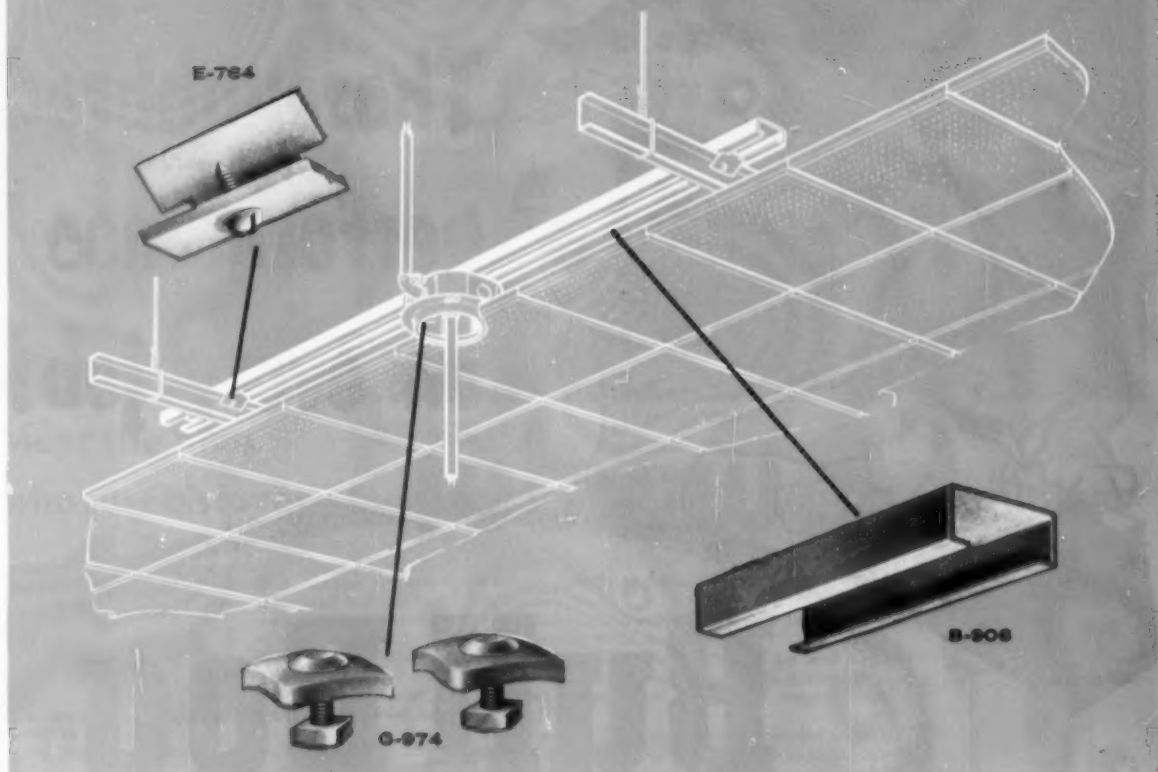


100 Kva single phase

**SORGEL ELECTRIC CO., 836 West National Avenue, Milwaukee 4, Wis.**  
*Sales Engineers in Principal Cities*



# Kindorf makes hung-ceiling jobs easy!



Here's the simplest possible answer to the fixture installation problem on hung ceiling jobs. No need to tax your ingenuity fabricating supports to adhere to the spacings of your lighting plan; simply lay a short length of Kindorf channel B-906 slot-side down across the runner bars—*anywhere*. Fasten it easily by means of our new E-764 channel clips and there you are! An outlet box (Steel City of course) may be attached anywhere along the slot by means of our G-974 stud nuts—or, if mechanical support only is required, a hanger rod B-913 nut combination does the trick. Nothing could be simpler—or cheaper to install.

## KINDORF a basic material

A PRODUCT OF STEEL CITY ELECTRIC COMPANY  
PITTSBURGH 33, PA.



**Thoroughbred  
performance  
on every job!**

# Bull Dog *Tape*

There's a  
**BULL DOG TAPE**  
for every purpose

- FRICTION
- RUBBER
- PLASTIC

BULL DOG TAPE goes on fast . . . sticks tight and stays tight. Splices neatly . . . extra strong and non-raveling. High dielectric strength for complete all-round electrical protection. BULL DOG resists weather and moisture . . . stands up longer on the job. Make BULL DOG *your* pet tape!

*Sold only  
through verified  
wholesalers*



Another quality product of

**BOSTON**

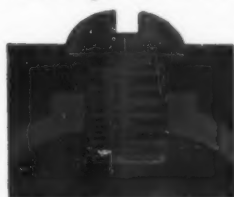
BOSTON WOVEN HOSE & RUBBER COMPANY  
BOSTON 3, MASSACHUSETTS

Also manufacturers of Garden Hose • Nozzles • Matting • Stair Treads



Meet the man  
who just discovered

# Tube-weld fittings!



This happy master-electrician has just had the pleasant experience of using his first Tube-Weld fitting. You, too, will agree that Tube-Weld's new concept in fitting design is the real

answer to fitting problems. They are precision-made of one piece heavy gauge welded steel tubing which has been accurately drawn and sized for controlled uniformity. These fittings cannot open or spread and far surpass UL requirements.

Tube-Weld fittings represent an entirely new idea in quality, design and price. They are available in  $\frac{1}{8}$ ",  $\frac{3}{4}$ " and 1" sizes, and have the following features:

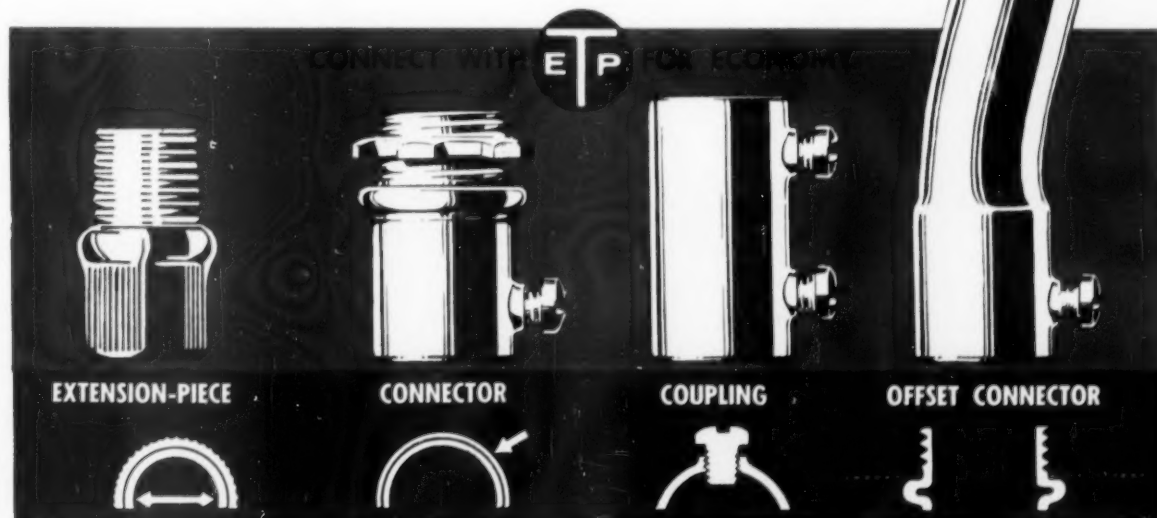
- Extra long offsets provide exceptionally easy pulling of wire.

- Longer length of fitting provides maximum support for conduit.
- Connector shoulders are uniformly flat assuring perfect centering in the box.
- All threads are rolled instead of cut and have 54% greater stripping strength and 66% greater snapping strength (independent laboratory report) over cut threads.
- Lustrous zinc finish and carefully beveled edges add a distinctive appearance — allow largest inside working diameters.
- Carefully and smartly packaged for ease in shelving and identification. For descriptive brochure and additional information, write or call:

## ELECTRIC TUBE PRODUCTS

A Subsidiary of Berger Machine Products

74-16 Grand Ave., Maspeth (N.Y.C.), N. Y., DEfender 5-8000



# GARCY

## 5600 Series

### Recessed Luminaire

with one-piece plastic shield



### **Weigh it**

against other Large-Area Luminaires

Compare this plastic panel with the shielding on other 4 ft. by 4 ft. fixtures. Where the conventional flat panel sags of its own weight, Garcy's die-formed contour gives lasting stability...permits lighter weight and reduced ceiling load. Installation, cleaning and relamping go more quickly. The panel swings down easily in its hinged frame, puts no strain on the fixture or the worker.

Compare it also for beauty, durability, efficiency. When the fixture is lighted, the contour is hardly noticeable, lending an unobtrusive but interesting "character" to the ceiling treatment. The light is evenly diffused and efficiently transmitted. For the luxury look in lighting, choose Garcy's 5600 Series.

Available in the following sizes: 4'x4'; 2'x2'; 2'x4'; 2'x8'. Also available with Alba-Lite glass or louvre shields. 1/16" Plexiglas shield in pattern shown is available in matte finish.

Send for Bulletin 552-L

# GARCY

## **Quality by Design**

Garden City Plating & Mfg. Co., 1730 N. Ashland Ave., Chicago 22, Illinois  
In Canada: Garcy Co. of Canada, Ltd., 1244 Dufferin Street, Toronto 4







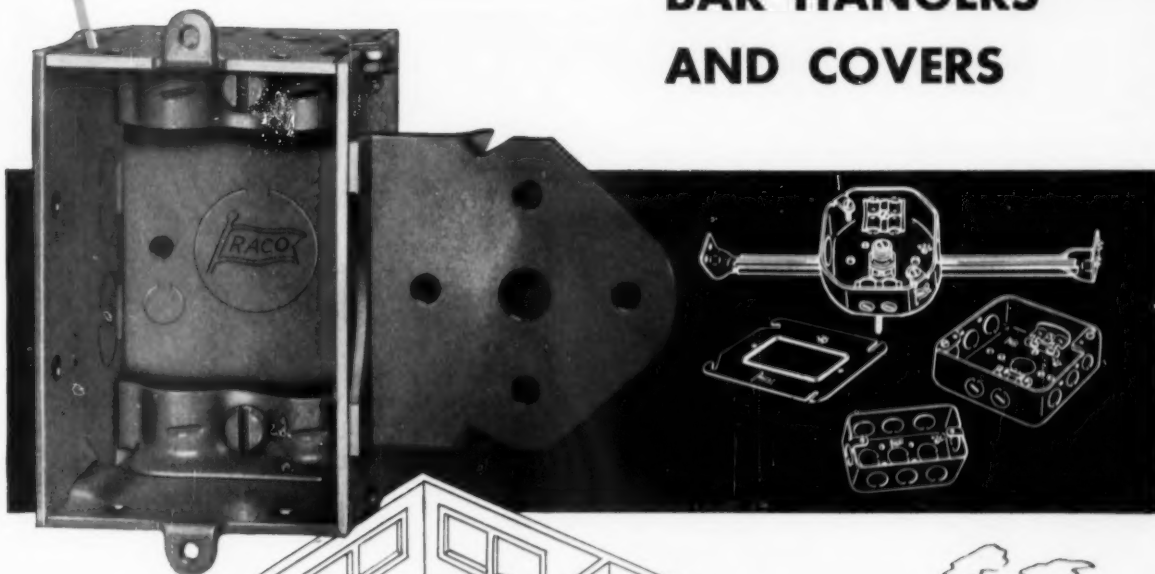
# SYMBOL OF QUALITY

## SWITCH BOXES

## OUTLET BOXES

## BAR HANGERS

## AND COVERS



### A COMPLETE LINE OF ELECTRICAL BOXES

You can readily recognize the high quality of RACO products... beautifully finished... smooth edges... deep, clean-cut threads. Made of heavy gauge steel... engineered to exceed local and national code requirements. On new jobs... on rewiring you can always rely on RACO. Write for complete information.



"A RACO BOX FOR EVERY NEED"

**ALL-STEEL EQUIPMENT INC.** Aurora, Illinois



WALTER D. VANCE, JR., Vice President • California Electric Co., reports:

**"We saved 14 days installing  
527 fixtures by using  
'UP-RIGHT' Scaffold-on-Wheels"**

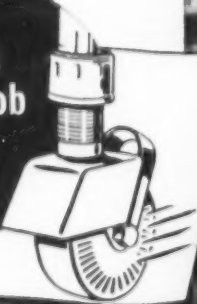
Man-hour savings on this General Motors warehouse job amounted to over 40%. Up-Right Scaffold is so light it is easily assembled by one man. Individual 1 piece aluminum alloy sections are unfolded and set one on top of the other. They lock into place instantly.

**14' tower  
assembled in  
2 minutes**

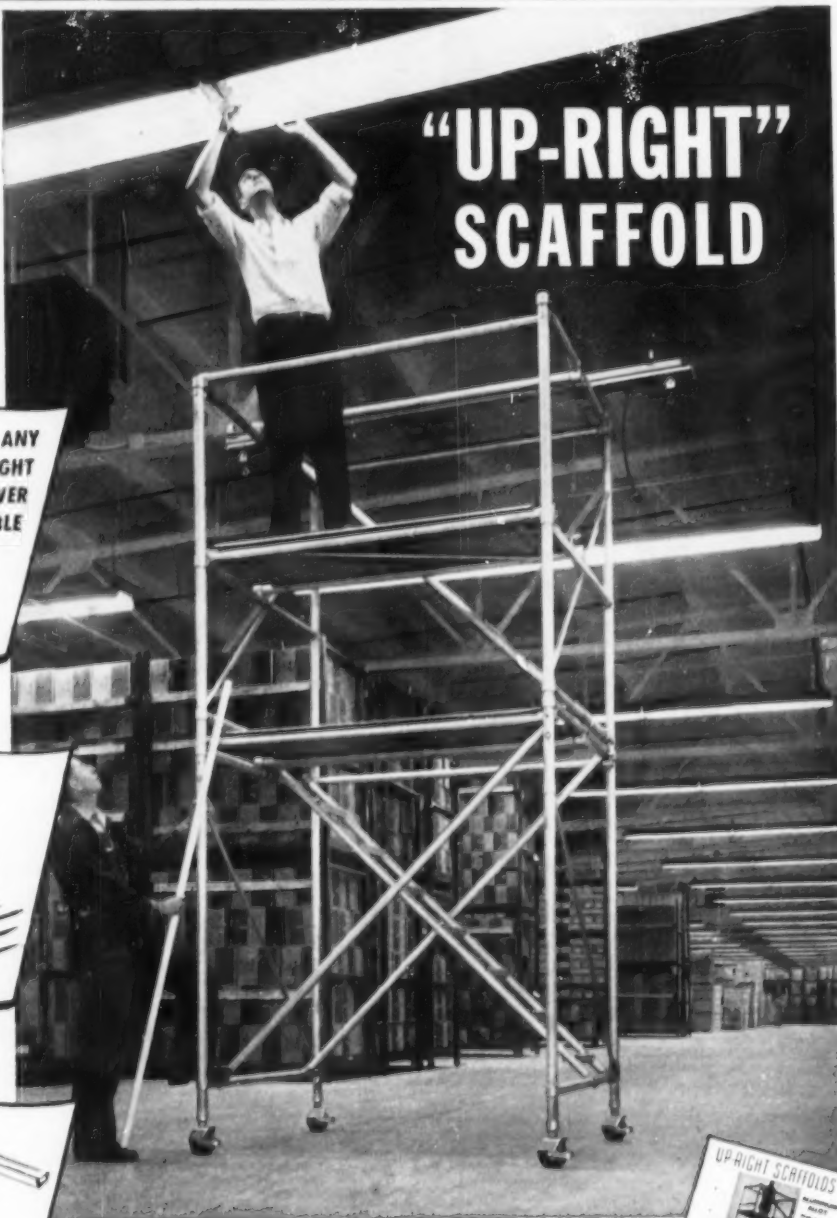
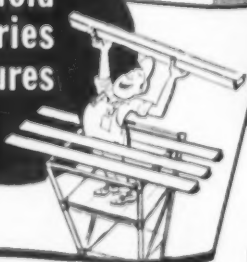


**ANY  
HEIGHT  
TOWER  
AVAILABLE**

**Rolls  
with job**



**Scaffold  
carries  
fixtures**



Write for descriptive circular ➡

### **"UP-RIGHT" SCAFFOLDS**

Dept. 159 • 1013 Pardee Street • Berkeley, California

Factories: Berkeley, Calif. and Teterboro, N. J. • Offices in all principal cities





## **"\$175 freight for \$160 worth of cable ...** *but the contractor'll save thousands!"*

THAT'S almost the tail-end of a story that began three days earlier in New York when George Jacobs, Circle executive, answered his phone.

"George?" the receiver cracked urgently, "I'm in a jam. I need 2500 feet of RR cable in a hurry."

Another emergency, thought Jacobs resignedly. "Sure, but why all the excitement about 2500 feet of RR cable? We'll get it out in the morning."

"You can't," said the voice on the other end of the line anxiously. "It's a special, you'll have to make it up."

"What?" sputtered Jacobs excitedly. "You want me to tie up all that equipment for 2500 feet of RR cable? When do you need it?"

There was an uncomfortable pause on

the other end and then, questioningly, "By the end of the week, George? Look, there's a hydro-electric project out here. Contractor on the job needs this wire to finish up. Somehow, 600 volt cable was supplied instead of the 1000 volt stuff the government specs called for."

The voice took time out for a breath. "This job's got to be finished fast. River water's rising and to top it off - there's a severe penalty clause for each day lost by the contractor. I've looked all over this state for 1000 volt, 12-1 stranded. I can't find any. Now it's up to you."

For a brief moment there was silence on the phone. Jacobs could hear the other's faint breathing some three thousand miles distant. Finally he said, "All right, we're wasting time. Let me get started. You'll have the cable in a week."

The "voice" was that of Leslie Gilbert, Portland Electric and Plumbing Co. The project was The Dalles Dam on the Columbia River. The sub-contractor was the Willamette Iron and Steel Co. The RR cable, incidentally, was made, shipped, and on the job in four days.

Why do we tell this story? Because it's another example of Circle service to customers. Giving this kind of service is basic policy at Circle - the result of a flexible organization out of sympathy with "red tape" and "stuffed shirts."

That is why working through a Circle distributor is always your best assurance of adequate supplies quickly and dependably delivered to the site. Specify Circle on your next job. Circle Wire and Cable Corp., 5500 Maspeth Avenue, Maspeth, New York, Dept. A1.



# **CIRCLE**

**WIRE & CABLE**  
 a subsidiary of  
**CERRO DE PASCO**  
 CORPORATION

PLANTS: Maspeth and Hicksville, N.Y. SALES OFFICES: In all principal cities.  
 RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES • NEOPRENE SHEATHED CABLES

### **New Wiring Calculator — FREE!**



Send today for this handy, useful wiring aid. Gives conduit sizes, ampere capacities, and helpful motor running data.



*"Shucks, Rajah, this is nothing compared with the torture electrical users who buy direct put themselves through."*

"Electrical Wholesaler Distribution reduces the Manufacturer's selling cost and thereby reduces the selling price of electrical supply material to the user. Therefore, our policy has been to distribute Thomas & Betts products exclusively through the Electrical Wholesaler."\*

LOOK FOR THIS SIGN —



IT'S THE MARK OF AN AUTHORIZED **T & B** DISTRIBUTOR

**THE THOMAS & BETTS CO.**

INCORPORATED

34 BUTLER STREET, ELIZABETH 1, NEW JERSEY

THOMAS & BETTS, LTD., MONTREAL, P. Q., CANADA

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

\*Quoted from the T & B Plan of Wholesaler Distribution. If you would like to know the complete story of the T & B Plan, write:



## Striking New Building for a Twin City Insurance Society



Latest addition to the growing Minneapolis, Minn., business center is the beautiful new home office of the Lutheran Brotherhood, a fraternal life insurance society. This modern building boasts a number of unusual features, including a unique sunken garden and terrace, exterior walls of blue-green porcelain-enamel steel and 640 windows of double-pane plate glass.

One of the requirements for this building was an electrical system of the highest quality. That's why Phelps Dodge building wire and paper insulated power cable were installed exclusively.

On every wiring job where top-quality materials, expert workmanship and experienced "know-how" are called for, *it pays to rely on Phelps Dodge and your Phelps Dodge distributor!*



**PHELPS DODGE COPPER PRODUCTS  
CORPORATION**

**SALES OFFICES:** Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.



In cleaning this wing fuel tank, Capital Airlines selects Okocord cables for their ability to withstand mechanical abuse as well as contact with cleaning compounds, acetone, hydraulic oils and high-octane gasoline.

## where high octane fumes require maximum safety, airline maintenance shop demands Okocord\* cables

In 1952, Capital Airlines installed heavy-duty Okocord cables on all their portable tools and explosion-proof trouble lamps. The change was made only after Capital officials had investigated cords supplied by many leading manufacturers and were fully convinced that Okocord provided the safest possible service where high octane fuel and vapors were present.

Today, the company still uses Okocord exclusively for this type of work. According to Capital's Safety Director, C. F. Schaub, here's why:

"The cords used in aircraft maintenance work get rough handling and frequently come in contact with chemicals, such as cleaning compounds, paint thinner, acetone and hydraulic oils, that weaken cord sheaths badly. Then, too, you've got to use these cords inside plane wings and parts of the fuselage where gas vapors are highly concentrated. It doesn't take much imagination to guess what'd happen if a cord shorted there. We have to use the very safest—Okocord!"

Okocord can help you solve your cable safety problems too. For full details, contact your nearest Okonite representative or write for Bulletin EC-451, The Okonite Company, Passaic, N. J.

\*This product formerly carried the trade name Hazacord



where there's electrical power . . . there's **OKONITE CABLE**



## smart modern appearance

helps make **CHROMALOX** Electric Baseboards the Quality Line

Homeowners are quick to appreciate the clean, streamlined styling of Chromalox Electric Baseboard Heaters . . . and their smooth, uncluttered flow from wall-to-wall and around corners.

With factory-primed surface, they're ready to paint in any color desired. No need to convince Mrs. Homemaker that one of 27 shades of white or other factory colors "will look just fine."

The *top-front* warm air discharge—another Chromalox quality design feature—avoids messy wall streaking . . . makes the world's cleanest heat just that.

The baseboard idea itself is strictly a quality heating idea. None other gives the genuine comfort of baseboards . . . that put heat along out-

side walls and windows where most heat loss occurs.

And the silent, finless Chromalox strip element cannot catch or char dust, dirt and lint, will never sag.

Available in four practical lengths. Two adjacent connections wire-up 16 feet of heat. Simply attached and connected. Wiring from bottom, back or either side. Built-in thermostat and convenience outlet sections also available.

Write for more details today—mention Bulletin 800A.



**Edwin L. Wiegand Company**

RESIDENTIAL HEATING DEPARTMENT

7637 Thomas Boulevard, Pittsburgh 8, Pa.

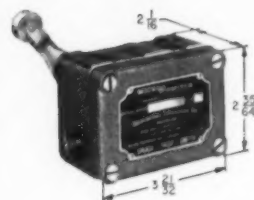
*Heat Better . . . Electrically*

....

# MICRO SWITCH . . . FIRST IN PRECISION SWITCHING



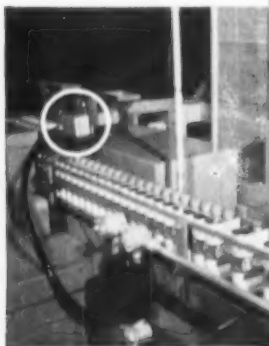
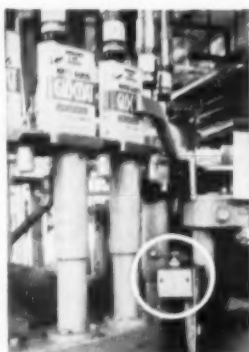
Mounted in the midst of this foamy rotary filling machine, this MICRO SWITCH splash-proof switch stops the machine if the liquid level drops below a predetermined point. The precise performance of the switch is unaffected by the splashing of the liquid.



MICRO SWITCH Splash-Proof Switches are constructed to resist the splash of liquids. A seal on the actuating shaft and a gasket on the cover gives a good seal against normal splash conditions. A heavy aluminum housing protects the enclosed switch. These switches combine long electrical life with accurate repeatability. They are available with adjustable roller-arm actuators (shown) or with push-rod plunger actuators. Can be supplied with a variety of electrical ratings and contact arrangements.

## Splashed all day with liquid wax...

MICRO SWITCH precision switch is used to prevent "jam up" on a rotary can-filling machine. If the platform sticks and does not lower to the level of the conveyor, the switch stops the conveyor until trouble is corrected.



Switch at the left is held operated by the nozzles of the cans. Should a can be upset, or reversed, the switch actuator releases, opens the circuit and the conveyor stops. Another switch keeps track of the supply of knock-down shipping cases, in a similar manner. It stops the conveyor if the supply is low.

See MICRO SWITCH Catalog No. 83 for complete information on the wide line of heavy-duty precision switches for industrial use. Wire today.



## MICRO SWITCH Precision Switch performance is unaffected

MICRO SWITCH controlled equipment is faster and more efficient—produces more in less time. Thousands of plant superintendents, electricians and maintenance men have made their equipment "perk up" with MICRO SWITCH precision switches.

Johnson's Wax Company engineers chose splash-proof MICRO SWITCH precision switches to control packing equipment in their modern Racine plant. From controlling the level of the rotary filling machine, through every packaging step, MICRO SWITCH units insure safe, efficient operation as over 200 cans are filled in each line per minute.

There is a MICRO SWITCH distributor near you. Let him show you a variety of switches and practical applications that have paid off for others. Send for MICRO TIPS DIGEST. It's jam-packed with ideas.

# MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS





## "Week-end Wizard"

The spirit of do-it-yourself has made us a nation of handy men. At the same time, it has sharpened our appreciation of power tools and equipment: Simplex-TIREX cords and cables, for instance. These expertly engineered cords and cables are on the job everywhere: in home workshops, in factories, in mines, and on giant construction projects.

TIREX cords and cables, newly improved for greater flexibility, feature cured-in-lead Neoprene Armor that resists abrasion, oil, heat and water . . . gives longest service.

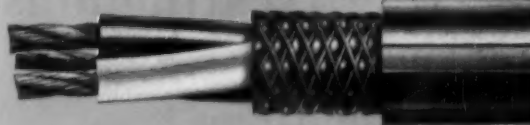
**SIMPLEX WIRE & CABLE CO.,**  
79 Sidney Street, Cambridge 39, Mass.



Wire sculpture by Henry Szafarz



# Simplex



Tirex Portable Cable

A NEW IDEA IN POWER DISTRIBUTION

WESTINGHOUSE

# UNI-BUS



From Westinghouse comes a new busway—a method of distributing power—so new, so much better, it makes conventional methods seem old fashioned. Uni-bus!

For the first time, it combines the advantages of plug-in duct with a low-impedance system.

And Uni-bus has a new idea in installation . . . the flexible connector. This one unit does away with all special fittings—simplifies time-consuming field measuring. This feature combines with special clip-on hangers to effect time savings during installation.

Uni-bus is the only completely safe busway because it is impossible for anyone to touch live parts through plug-in openings. Added protection is provided by the unique plug-in devices and triple-wrapped insulation on bus bars.

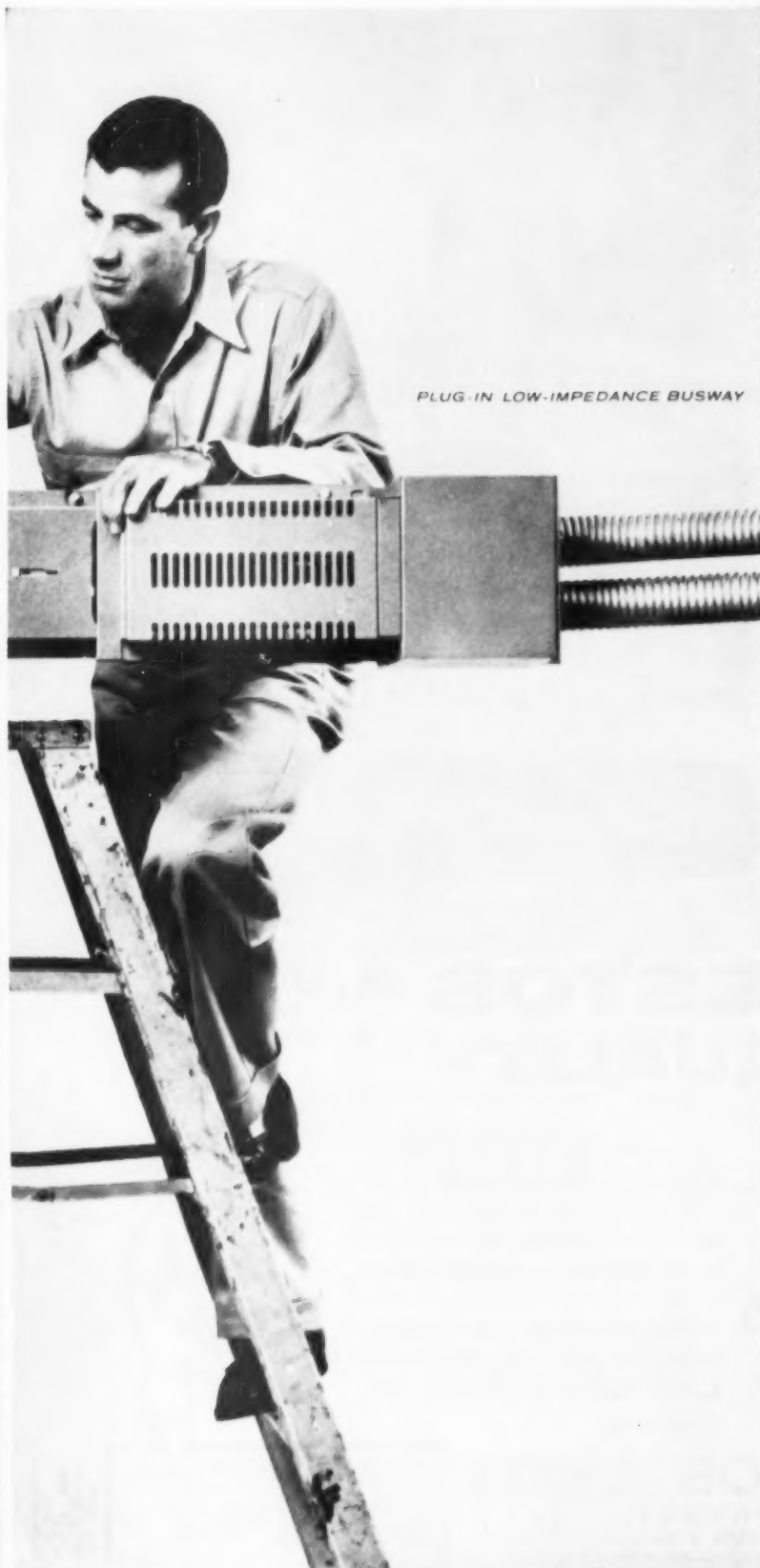
The features making these benefits possible are shown at right. Call your Westinghouse distributor today. Or write for booklet, B-7015, Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pa.

J-30239

YOU CAN BE **SURE**...IF IT'S

## Westinghouse

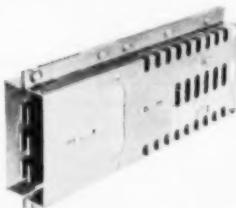




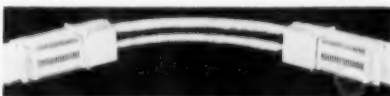
PLUG-IN LOW-IMPEDANCE BUSWAY

## Construction details of Uni-bus, new power distribution system

Many reasons make Uni-bus unique in the busway field. Three exclusive features are detailed here:



Safety slide . . . Interlocking slide keeps plug-in openings closed until plug-in device is fastened to busway. Device cannot be removed when slide is opened. System has 12 outlets per 10-foot length.



Flexible connector . . . One unit does the job normally requiring many special fittings in other busways. The connector consists of two attachment boxes joined with flexible conduit and cable.

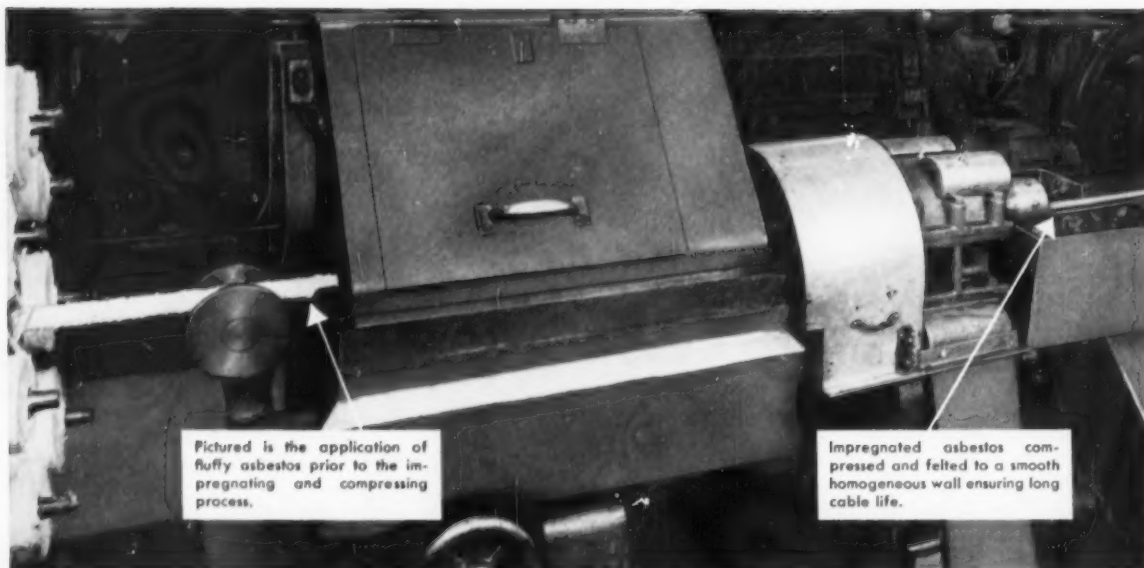


Uni-bus plug . . . Here is convenience and safety in one plug-in system. When cover is open no live parts are exposed. Contacts are visible in open position for positive identification. Contacts interlock so circuit is not opened or closed on bus bars.

At left is an illustration showing why Uni-bus is your best power distribution buy.

YOU CAN BE SURE...IF IT'S

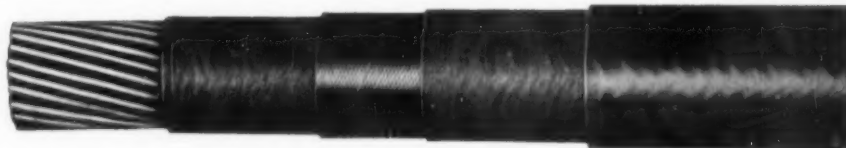
# Westinghouse



Pictured is the application of fluffy asbestos prior to the impregnating and compressing process.

Impregnated asbestos compressed and felted to a smooth homogeneous wall ensuring long cable life.

## Felted Asbestos Walls + Impregnation with Selected Compounds + Quality Varnished Cambric Tapes . . .



*That's the Backbone of*

# ROCKBESTOS A.V.C. (N.E.C. TYPE AVA) QUALITY

Different brands of N.E.C. Type AVA wire and cable may look alike on the surface but the sure proof of quality that means dependable service is beneath the braid.

In the Rockbestos A.V.C. construction dense, felted, thoroughly impregnated asbestos walls seal the varnished cambric tapes away from air and moisture.

The varnished cambric tapes are made to Rockbestos exacting specifications and

are applied under controlled methods assuring uniform dielectric strength.

The result . . . you get long life and dependable service under every type of operating conditions . . . in temperatures up to 230°F.

Complete construction and test specifications of Rockbestos A.V.C. are in the new booklet: "Specifications RSS-88". Write for your copy.



### ROCKBESTOS PRODUCTS CORPORATION

NEW HAVEN 4, CONNECTICUT

NEW YORK • CLEVELAND • DETROIT • CHICAGO • PITTSBURGH • ST. LOUIS  
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#### STOCKED COAST TO COAST

Standard Rockbestos A.V.C. construction (N.E.C. types AVA, AVB, etc.) are available for immediate shipment. Call or write nearest branch office.

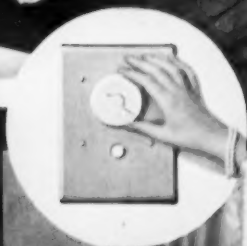




⤴ "Once upon a time"



⤵ ...and so to sleep...



⌚ Peep time...



⌚ "Water, Daddy"

## The new age of lighting is here!

**...replace the old-fashioned wall switch with LUXTROL Light Control**

Only once in a long, long time does something as dramatically new as LUXTROL Light Control come your way!

Take full advantage of this new concept of lighting. There are big profits in it for you.

**LUXTROL Light Control creates any level of light... from dark to full bright! Just by turning a dial.**

Look at the nursery scenes above. How easy it is, with LUXTROL, to dial the right light for reading. How gradually, gently, you can diminish light... to put a child in the mood for sleep.

Notice how you can dial a soft light for baby-checking. And add a bit more visibility for "night-calls".

The nursery is just an example... one of many rooms where LUXTROL now gives lighting convenience undreamed-of before. LUXTROL also gives very practical and decorative lighting effects in the living room, dining room, recreation room. And, likewise, in stores, restaurants, schools, churches, hospitals.

**LUXTROL is a cool, efficient autotransformer... not a rheostat.** It is precision-engineered... silent... safe. Approved by Underwriters' Laboratories. Installation is simple... in place of the out-moded wall switch.

Make some extra profits... and satisfied customers... with LUXTROL Light Control. Mail the coupon today.



A product of  
THE SUPERIOR ELECTRIC COMPANY

THE SUPERIOR ELECTRIC COMPANY  
8126 Demers Ave., Dept. C E  
Bristol, Connecticut

Please send me full design data on new LUXTROL Light Control... and the name of my nearest LUXTROL distributor.

Name \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# SPECIFY QUALITY...

## INSIST ON MCGILL® PORTABLE LAMP GUARDS

McGill Industrial Lampguards give you an extra margin of quality—in materials and workmanship—that assure a safe dependable light; where you want it, when you need it. Parts and materials are all carefully selected for resistance to wear and abuse in rugged industrial service. 660 watt, 250 volt sockets. Choose the right lamp guards for your needs from the more than 100 different type offered by McGill.

*Underwriters Laboratories Inspected*



### No. 7100 SR Lamp Guard

Clamp arrangement allows quick lamp changing without tools. Gray Neoprene-butyl handle, reflector, LEVOLIER® switch and extra heavy steel cage.



### No. 5025 SRG Service Light

Completely grounded service light, 15 amp., 125 volt convenience outlet built into molded phenolic handle. Safe on-the-spot source for power tools, etc. 25 feet 16-3-SJ black rubber cord.



### No. 5000 SR Lamp Guard

With 15 amp., 125 volt convenience outlet in impact and heat- and grease-resisting, positively insulating molded phenolic handle. No-Rol cage and reflector.



### No. 3006 Vaporproof Lamp Guard

Watertight, vaporproof and moisture proof for complete safety. Heat and impact resisting glass globe screws into a silicone rubber gasket. Handle molded of macerated phenolic.



### No. 652 Lamp Guard

Rubber hook handle, thumb release clamp for easy bulb replacement can be hung, for maximum light, from hook or handle.

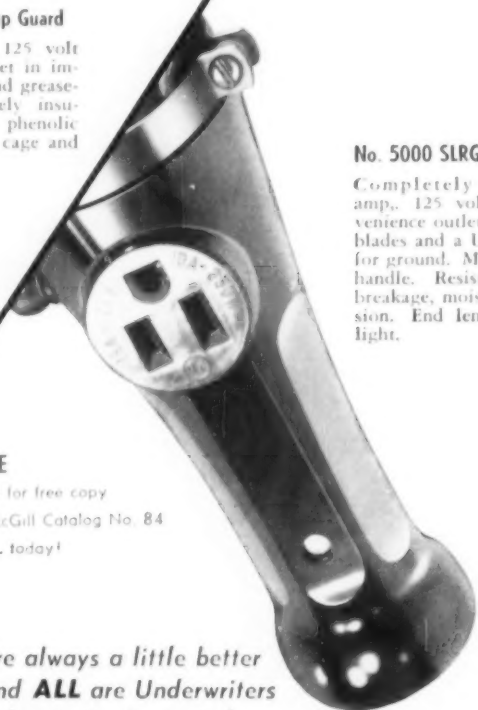


### No. 5000 SLRG Lamp Guard

Completely grounded, 15 amp., 125 volt 3-wire convenience outlet for 2 parallel blades and a U shaped blade for ground. Molded phenolic handle. Resists oil, grease, breakage, moisture and abrasion. End lens concentrates light.

### FREE

Send for free copy of McGill Catalog No. 84 . . . . today!



**MCGILL®**  
ELECTRICAL SPECIALTIES

are always a little better  
and **ALL** are Underwriters  
Laboratories Inspected

McGILL MANUFACTURING COMPANY, INC.

450 N. Campbell St., Valparaiso, Indiana



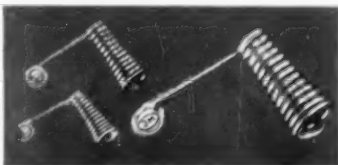
*Now available from your jobber!*

Reg. U.S. Pat. Off.  
**SCOTCHLOK** Type R  
BRAND  
**Electrical Spring Connectors**

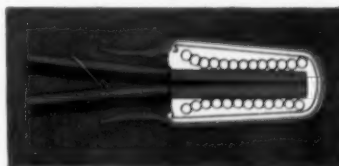
*With "live" Spring Action . . . Strong . . . Fast . . . Pre-Insulated!*

**"Scotchlok" Type R** — the *red* connector with the *real* holding power — takes all common wire combinations from #10 to #16 AWG . . . the widest range of any connector!

New "SCOTCHLOK" Type R is the same tight-holding construction as regular "SCOTCHLOK" — and it's pre-insulated!



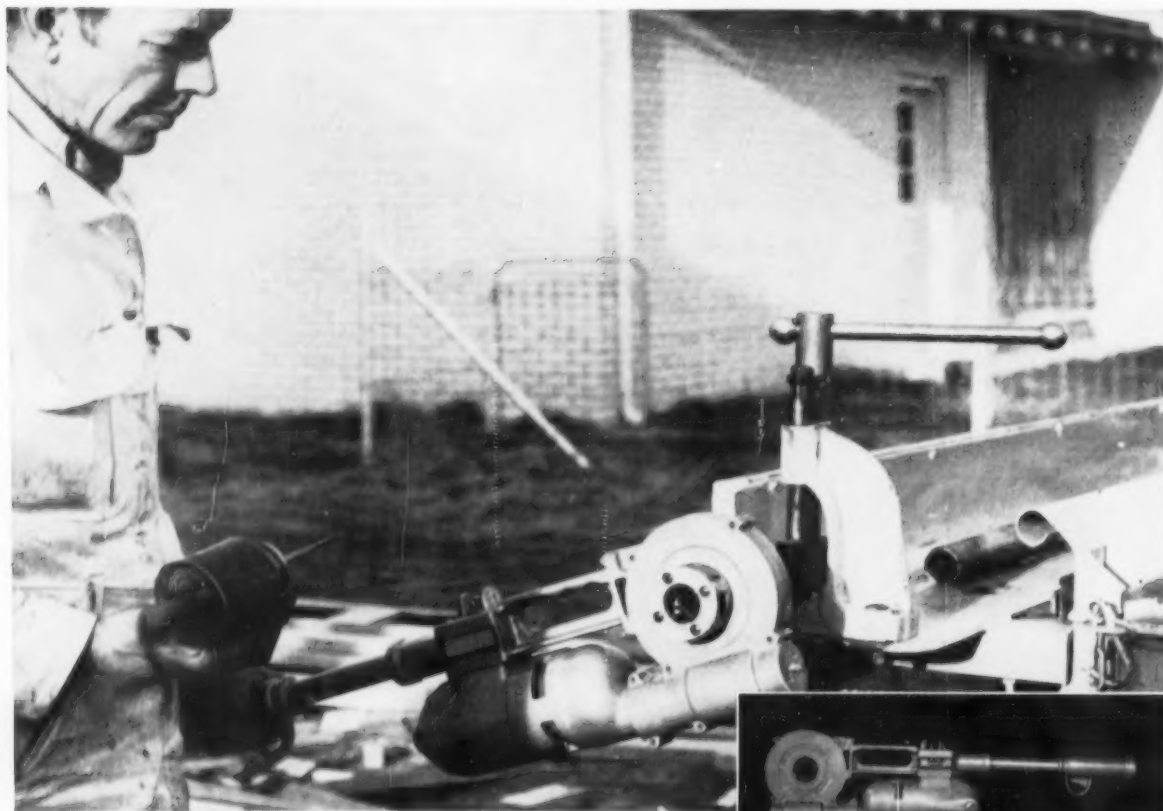
After wires are inserted, the *live* spring action seizes them in a bulldog grip — a *live* spring action that no amount of vibration or jerking can jar loose!



**SEND FOR FREE SAMPLES!** See for yourself how good "SCOTCHLOK" Brand Type R Connectors really are! Just write on your letterhead and we'll send you free samples for testing.  
 Address: 3M Company, St. Paul 6, Minn., Dept. CB-17.

The term "SCOTCHLOK" is a registered trademark of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N. Y. In Canada: P. O. Box 757, London, Ontario.





## Threads Conduit in seconds ...the Lawco, Jr. PORTABLE PIPE THREADER

Here's the answer to those slow, tiring, hand-threading jobs. The Lawco, Jr. Portable Pipe Threader does the work in seconds. This modern portable power tool threads the smallest to the largest conduit. Simple adapters and speed reducers handle pipe from 1/4-inch to 6".

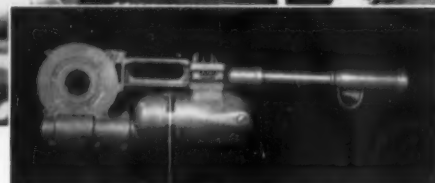
Its operation is simple. Just position Lawco, Jr. on the conduit, press the trigger, and the power unit drives the cutting dies. You're finished in no time, and right at the location where you are installing the conduit.

And Lawco, Jr. comes in handy for other jobs, too. Several are illustrated at the right. In addition to these applications, you can use your Lawco, Jr. for driving nuts and bolts, and hoisting weights up to 500 pounds.

This light weight (20 lbs.) tool is precision built for years of service. Write for details.

### VELOCITY POWER TOOL CO.

201 North Braddock Avenue, Pittsburgh 8, Pa.



The Lawco, Jr.—portable, versatile, compact. Does a variety of jobs faster, better.



Augering operation with Lawco, Jr. Efficient in vertical or horizontal operations.



Post hole application using square shank. Lawco, Jr. does it faster.



There's nothing better for pulling wire through conduit than the Lawco, Jr. The unit's portable feature speeds work.



# FEDERAL PACIFIC'S ALL-NEW 1 1/16" STABREAKER

**DOUBLES  
PANELBOARD LIGHTING  
CIRCUITS...**

**SLASHES  
PANELBOARD SPACE-COST  
REQUIREMENTS!**

Now you can get twice the number of lighting circuits in Distribution Panelboards...without adding to cost...without taking up extra space. And it's all made possible by Federal Pacific's revolutionary new 1 1/16" wide single pole, NE-S frame STABREAKER. Just half the width of conventional single-pole NE breakers...it makes possible twice the number of lighting circuits in the same space. What's more, the cost of this remarkable breaker is considerably less than the cost of regular single pole NE breakers! And to top it all, this dollars and cents savings is in addition to the plug-in flexibility and installation ease common to all STABREAKER devices.

**...with all the  
quality features  
of regular  
AB breakers**



- QUICK MAKE—QUICK BREAK
- THERMAL MAGNETIC TRIP
- SILVER TUNGSTEN CONTACTS
- CENTER HANDLE TRIP INDICATION

The new 1 1/16" STABREAKER has every basic AB circuit breaker feature. But like wafer thin new watches, the mechanism has been rearranged to conserve width. All the time-tested and proved features have been retained.

For swift, over-the-counter panelboard service . . . get STABREAKER from your distributor's stock.

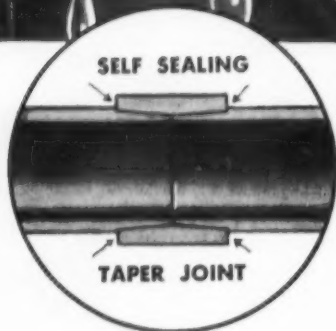
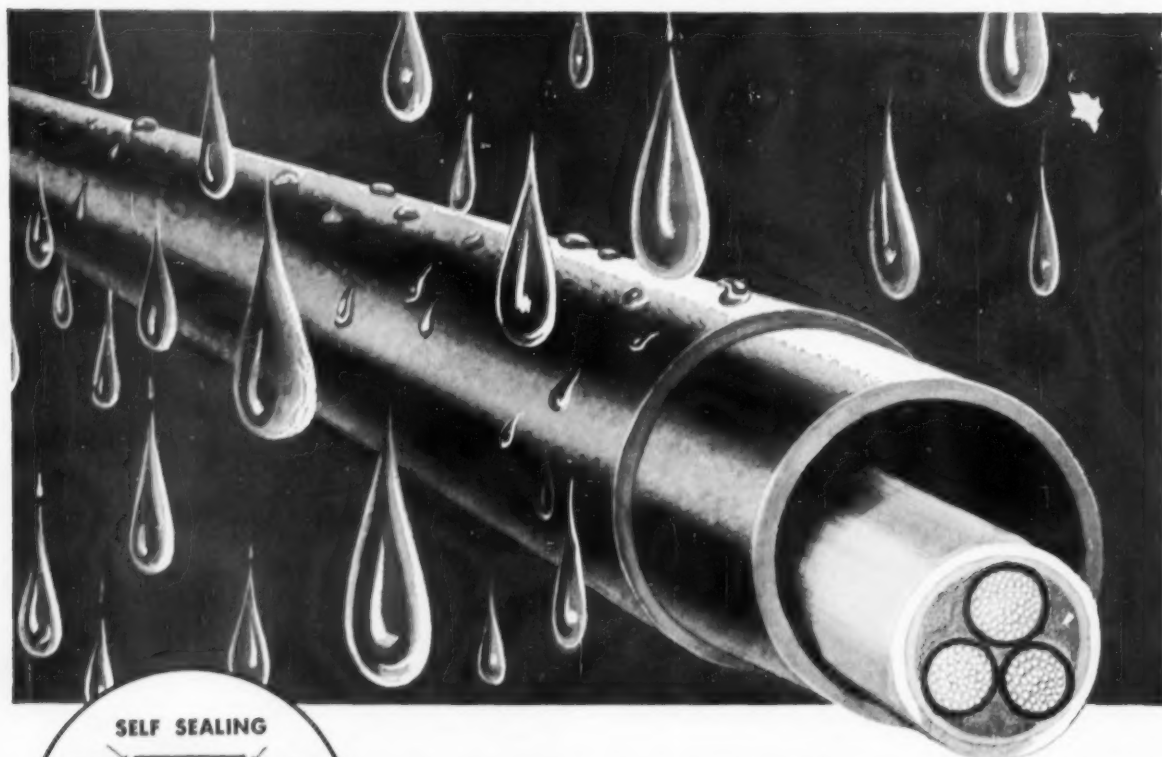
*Finest Products Engineered*  
**FEDERAL PACIFIC ELECTRIC**  
COMPANY

Main Office: 50 Paris Street, Newark 1, N. J.

Plants at Newark, N. J.; Long Island City, N. Y.; Cleveland, Ohio; St. Louis, Mo.; Dallas County, Texas; Scranton, Pa.; Los Angeles, Calif.; San Francisco, Calif.; Santa Clara, Calif.; Emeryville, Calif.; Affiliated Plant, Toronto, Canada.



# WATERTIGHT!



## Orangeburg Fibre Conduit Prolongs Cable Life

Keep out corrosive ground waters, and you prolong the life of underground cables, say utility engineers!

Why? Because ground waters containing corrosive elements derived from the soil and concrete encasement attack cable sheath and shorten cable life. Orangeburg's impermeable wall and self-sealing Taper-Sleeve Joint shed them *"like water off a duck's back."* You get maximum protection with Orangeburg.

Orangeburg protects cables in many other ways. Smooth bore, low co-efficient of friction reduce incidence of abrasion. Its material is

strong, tough, resilient, durable.

*No other conduit is easier to install* Light, 8-foot lengths and a complete line of bends and fittings speed installation. Taper-Sleeve Joints tap water-tight in a jiffy. Orangeburg lays faster and at lower cost than any other type of conduit.

Orangeburg Fibre Conduit has prolonged cable life at minimum expense for utilities, municipalities and industry since 1893.

Distributed by Graybar Electric Company and by General Electric Supply Company. Branches and stocks in principal cities.

WRITE DEPT EC-17 FOR CAT. 52

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y.

West Coast Plant, Newark, Calif.

## ORANGEBURG® FIBRE CONDUIT



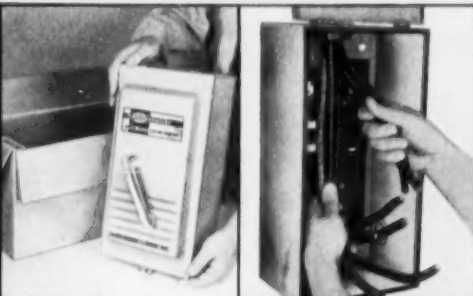
*For unequalled ease of AB-I installation...specify*

# FEDERAL PACIFIC STABREAKER

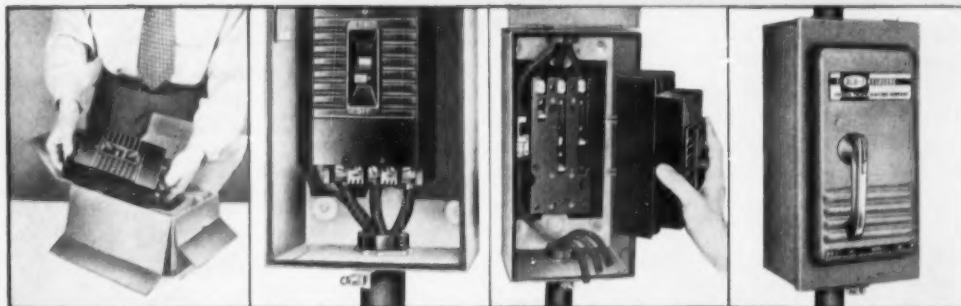
No other development has so greatly simplified the installation of AB circuit protection. It's Federal Pacific's revolutionary new STABREAKER...the circuit breaker that simply "plugs-in" to give you the easiest, most versatile installation possible! By simply adding stabs to its regular line of "NE" "NF" and "NJ" type AB circuit breakers... Federal Pacific makes it possible to "plug-in" all ratings from 15 to 225 amperes in only two general purpose STAB-Inclosures. With STABREAKER's unique "plug-in" installation there's no "blind" fishing for hidden screw holes because the breaker automatically aligns itself when "plugged-in". Bolts through breaker front provide extra holding power. Both the breaker and the enclosure are separately packaged which not only gives you wiring flexibility but minimizes your inventory.



## How to save time on AB-I installations



1. Select one of two standard STAB-INCLOSURES
2. Connect line side wires



3. Select STABREAKER rating desired
4. Connect load side terminals
5. Simply plug breaker in place
6. And installation is complete

**GET OVER-THE-COUNTER DISTRIBUTION PANELBOARD SERVICE WITH STABREAKERS AND PREFABRICATED PANEL ASSEMBLIES DIRECT FROM YOUR DISTRIBUTOR'S STOCKS!**

*Finest Products Engineered*

# FEDERAL PACIFIC ELECTRIC COMPANY

Main Office: 50 Paris Street, Newark 1, N. J.

Plants at Newark, N. J.; Long Island City, N. Y.; Cleveland, Ohio; St. Louis, Mo.; Dallas County, Texas; Scranton, Pa.; Los Angeles, Calif.; San Francisco, Calif.; Santa Clara, Calif.; Emeryville, Calif.; Affiliated Plant, Toronto, Canada.





## Merchandise moves better when **LITECONTROL LIGHTING** is the **R<sub>x</sub>** at the Drug Counter

Standard lighting doesn't have to be *dull* in either imaginative qualities or lighting efficiency. This handsomely lighted drug store shows what can be done when planning skill and standard quality fixtures are combined to obtain superior illumination at sensible cost.

The patterns the fixtures comprise are extremely interesting while providing even lighting of the merchandise. (Excellent for retail sales — particularly "impulse" purchases.) The fixtures themselves are Litecontrol's

No. 7724RS 2 lamp surface baffle type and they make this drug store's lighting dollar go a long way.

We've had a lot of experience in designing and manufacturing fluorescent fixtures for lighting and relighting stores, schools, offices, banks and factories. It is very probable that you will find the solution to a lighting problem right in our catalog.

**INSTALLATION:**  
East Springfield Pharmacy, E. Springfield, Mass.  
**ARCHITECT:**  
Louis Hinckley, Springfield, Mass.  
**ELECTRICAL ENGINEER:**  
E. M. Sullivan, Springfield, Mass.  
**LIGHTING CONSULTANT:**  
Jack Callender, Western Mass. Electric Co., Springfield, Mass.  
**GENERAL CONTRACTOR:**  
J. G. Roy Co., Springfield, Mass.  
**ELECTRICAL CONTRACTOR:**  
Branton Electric Co., Springfield, Mass.  
**FIXTURES:**  
Litecontrol No. 7724RS 2 lamp surface baffle fixtures, plastic sides, 35"-25" cutoff, with 40 watt standard cool white Rapid Start lamps.  
**INTENSITY:**  
75 footcandles in service.

  
**LITECONTROL** *Fixtures*

KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS



# FOR SUPERIOR INSULATION AND JACKETING CHOOSE **ALATHON**<sup>®</sup> POLYETHYLENE RESIN

The unique properties of ALATHON polyethylene resins make them suitable for both jacketing and insulating applications. Jacketing of black ALATHON withstands conditions of heat, moisture, and weather extremes — assures years of trouble-free service. ALATHON absorbs the shocks of rough handling and thereby speeds installation.

The electrical properties of ALATHON polyethylene resins are excellent. Their low power factor and dielectric constant remain essentially unchanged over a wide range of frequencies and temperatures. Their moisture resistance and lightness of weight make them eminently suitable for insulating applications.

A complete family of ALATHON polyethylene resin compositions is offered by the Du Pont Polychemicals Department. For the compound best suited to your particular use, send for complete details by mailing the coupon below.

## Jacketing of **ALATHON**<sup>®</sup>

- for greater durability
- for abrasion resistance



SHIELD

Insulation of **ALATHON**<sup>®</sup>  
for high dielectric strength  
and heat resistance

There is a difference in polyethylenes—

specify **ALATHON**<sup>®</sup>  
polyethylene resin



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E. I. du Pont de Nemours & Co. (Inc.)

Polychemicals Department

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Please send me complete information on Du Pont "ALATHON" polyethylene resins. I am interested in evaluating these materials for

Name \_\_\_\_\_ Position \_\_\_\_\_

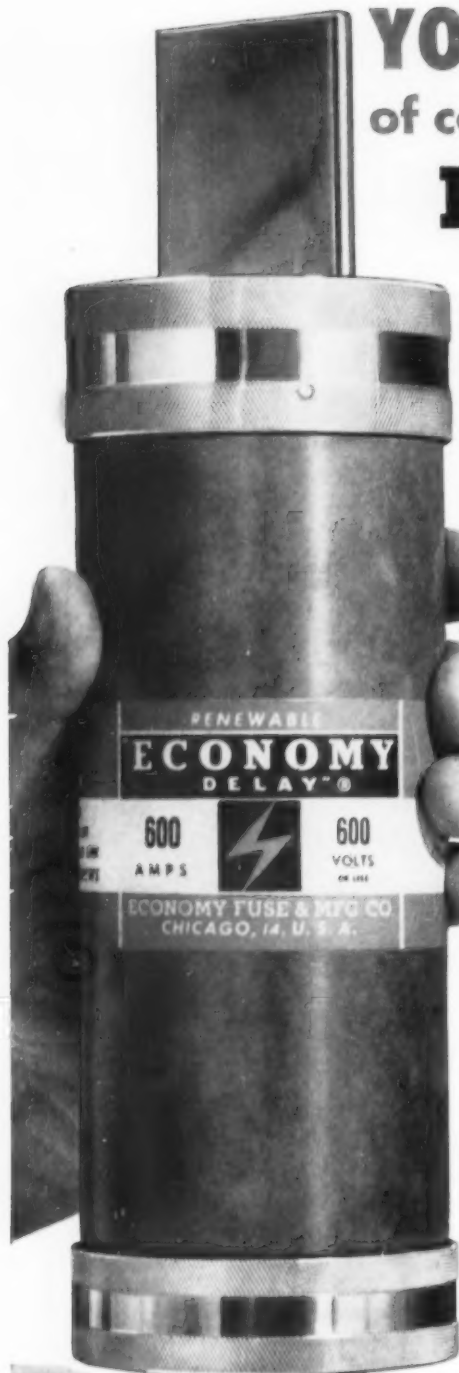
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# YOU'RE DOUBLY SURE of complete fuse protection with **ECONOMY fuses!**



## ECON® DUAL-ELEMENT CARTRIDGE FUSES

with exclusive Econ Alloy Thermo Element. Ideal for motor circuits with high starting torques. Knife blade or ferrule types, sizes from 2" to 13 3/8" and capacities to 600 amps for both 250 volts and 600 volts.



## ECO® ONE-TIME CARTRIDGE FUSES

provide unexcelled uniformity of current-time operation. Available in both knife blade and ferrule types, sizes from 2" to 13 3/8" and capacities up to 600 amps for both 250 volts and 600 volts.



## ARKLESS® MECHANICAL INDICATING FUSES

are recommended where positive indication is required. Guaranteed 100% to indicate. Knife blade or ferrule types, sizes from 2" to 13 3/8", capacities to 600 amps on both 250 volts and 600 volts.

## DELAY® RENEWABLE CARTRIDGE FUSES

offer superior protection for branch and feeder lines. Can be restored to original efficiency in a few minutes for a few cents. Knife blade or ferrule types, sizes from 2" to 13 3/8", capacities to 600 amps, 250 volts and 600 volts.



## ECONOMY RENEWABLE PLUG FUSES

offer low-cost replacement in circuits where repeat blows are experienced. Can be restored to original efficiency in minutes. Available in standard and sub-standard sizes, 10 to 30 amps capacities for 125 volts.



## CLEARSITE® PLUG FUSES

are standard for protection in any 125 volt line. They feature a transparent window that shows when and why it blows. Available in both standard and sub-standard sizes, capacities from 10 to 30 amps.

### Economy Gives Both—Complete Line Selection plus Creative Engineering!

You're sure of complete fuse protection because Economy's line is complete! It offers you *exactly* the type size and capacity of fusing that is engineered to your specific requirements. Illustrated are some of the popular Economy Fuses that meet definite needs. Economy fuses are the simplest, most practical method of reducing down-time due to needless blows and burnout. Proper selection means fewer replacements, lower-cost, dependable protection... and often, eliminates the need for expensive circuit breakers.

You're sure of complete fuse protection because each Economy Fuse is backed by nearly fifty years of

engineering excellence. Creative engineering by Economy anticipates your every fuse need... as exemplified in the pioneering and perfecting of such notable advances as the first renewable fuse to carry the seal of Underwriters' Laboratories... Arkless Mechanical Indicating and Eco One-Time Fuses... as well as the famous Econ Dual-Element Fuse.

It costs no more to be doubly sure of complete fuse protection. And, Economy Fuses are all backed by the seal of Underwriters' Laboratories. Call your local Economy representative for his recommendations... he can save you time and money.

**FREE** ... the Economy Fuse Folder No. 3 will be sent on request. This handy-sized folder lists nearly 400 different types, sizes and capacities of fuses.

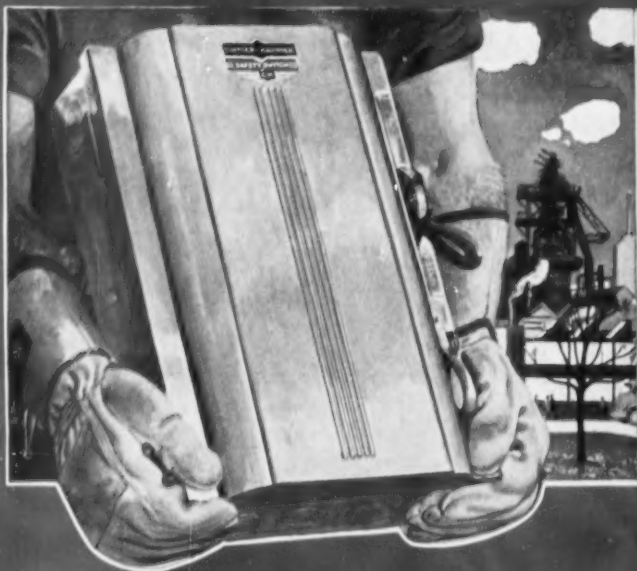
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SINCE 1911

**ECONOMY FUSES**  
FOR EVERY PURPOSE



ECONOMY FUSE & MFG. CO., 2717 Greenview Ave., Chicago 14, Ill.



# Built to take it!

## CUTLER-HAMMER'S 4105 TYPE A SAFETY SWITCH WITH DUO-STRENGTH OPERATING HOOKS ADDS NEW SAFETY TO SAFETY SWITCH PERFORMANCE

This is the finest, most modern safety switch . . . the new Cutler-Hammer 4105 Heavy Duty Type A Safety Switch. Tested and proven superior, the new C-H 4105 combines the famous C-H "heat proof dependability" with a new high-strength construction for safer, positive switch performance. Plant electricians, engineers and contractors solidly recommend and install Cutler-Hammer 4105 safety switches for every heavy duty application, and here's why.

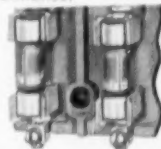
The new duo-strength operating hook and hook insulator insure the dependable performance so vital to reliable safety switch operation. The hook is made of high-strength steel and the insulator of glass fibre Alkide, known for its exceptional dielectric strength. The all-steel linkage between the contact blades and operating handle will faithfully open and close the switch blades even after years of continuous service. The Alkide hook insulator and operating rod insulating sleeve provide double insulation for double-sure safety.

Other important features of design include new automatic pressure fuse receivers; no screws to tighten . . . fuse can't work loose or be left loose while in service. Visible contact blades for quick, sure inspection at all times. Panel mounted mechanism of this new 4105 safety switch is readily interchangeable with that of the previous 4101 design for rapid replacement without case-and-conduit work.

Your nearby Cutler-Hammer Distributor is stocked and ready to serve you. Pick up your C-H 4105 safety switch today and see his complete line of electrical controls by Cutler-Hammer—leading manufacturer of *Automation Control*. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.



High strength glass fibre Alkide hook insulator and sleeve type operating rod insulator form the finest electrical safety. Hook is of high-strength steel for long-lasting switch performance.



Automatic pressure fuse receivers maintain uniform clip-to-fuse contact. Fuses won't work loose . . . no tools required to install fuses.



Sub-base panel mounting simplifies maintenance . . . quick, sure, economical. New 4105 mechanism will fit 4101 style case, no new case or conduit work.

Available in sizes from 30 amperes to 1200 amperes; 2, 3, and 4 poles; fusible and non-fusible.

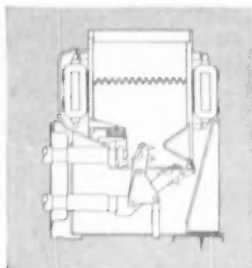


## METAL-CLAD SWITCHGEAR

# BETTER PROTECTION AGAINST HIGH CURRENT FAULTS

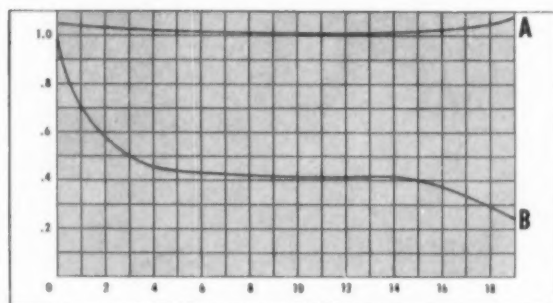
## uniform flux density across whole arc chute

When a high current fault opens an I-T-E 15 kv circuit breaker, the arc is practically swallowed up in the arc chute—faster and over a longer path than has ever before been possible. The reason lies in two unique construction features found only in I-T-E circuit breakers:



Path of arc through chute equipped with twin coils.

**1. Twin coils and closed loop magnet.** Arc current through the twin blowout coils develops a stronger flux density that is uniform across the entire arc chute. Arc is stretched farther, faster—cooled and extinguished in less time. And the forward part of the arc chute comes into use just as much as the back part. So arc chute life is significantly prolonged.

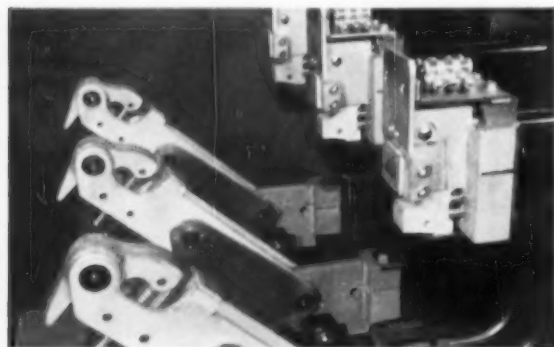


Flux density across entire length of arc chute.  
A. Twin coil B. Single coil

I-T-E quality means generally superior performance, better endurance under handling, and longer life in service. Yet it costs you no more.

**2. Laminated iron of transformer quality.** This superior iron construction keeps losses to a minimum. Magnetic field is not only stronger, but rises and falls in phase with the current through the arc. Thus the greatest magnetic pull on the arc occurs when it is most needed—at the top of the current cycles. These are both extra-quality construction features of the sort you can expect to find in I-T-E switchgear. All together,

Get complete information on I-T-E metal-clad switchgear—and the many engineering services available to help you realize greater economy and satisfaction in a system that meets your requirements. Available in ratings from 2.3 through 13.8 kv, 50 through 750 mva interrupting, and up to 3000 amperes continuous. Write to I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Phila. 30, Pa.



Fast interruption of low current arcs. As breaker opens, pistons force a jet of air between contact points—driving arc up into arc chute.



Horizontal drawout. Easiest to handle, safest, most convenient assembly known. So strong that switchgear is shipped factory assembled and ready for installation.

**I-T-E CIRCUIT BREAKER COMPANY—Switchgear Division**





**TWIN COILS**

**CLOSED MAGNET LOOP**  
Laminated Iron  
of Transformer Quality





## THE "GENERAL" ADDS TEN NEW STARS



Atlanta, Georgia  
Baltimore, Maryland  
Boston, Massachusetts  
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## *Let the Customer Decide*

Electric space heating people in these times are looking toward a new sales record for this year, a benign public favor for their wares and a soundly developing technology. They are confident, aggressive and optimistic—but occasionally frustrated.

Active objections to electric heat from utility policy-makers and discouraging electric rates are still common road-blocks in many areas to all electric living. But policies and attitudes are changing swiftly and increasing numbers of utilities are swinging over to the "favorable" and "actively promoting" categories with respect to electric space heating loads.

Summer peaks or their immediate prospect as a result of air conditioning growth have upset traditional load economics. Winter space heating is the only balancing load in sight. So attractive rates and active encouragement of electric heat are no longer unusual and appear to be inevitable over most of the United States within the next five to ten years.

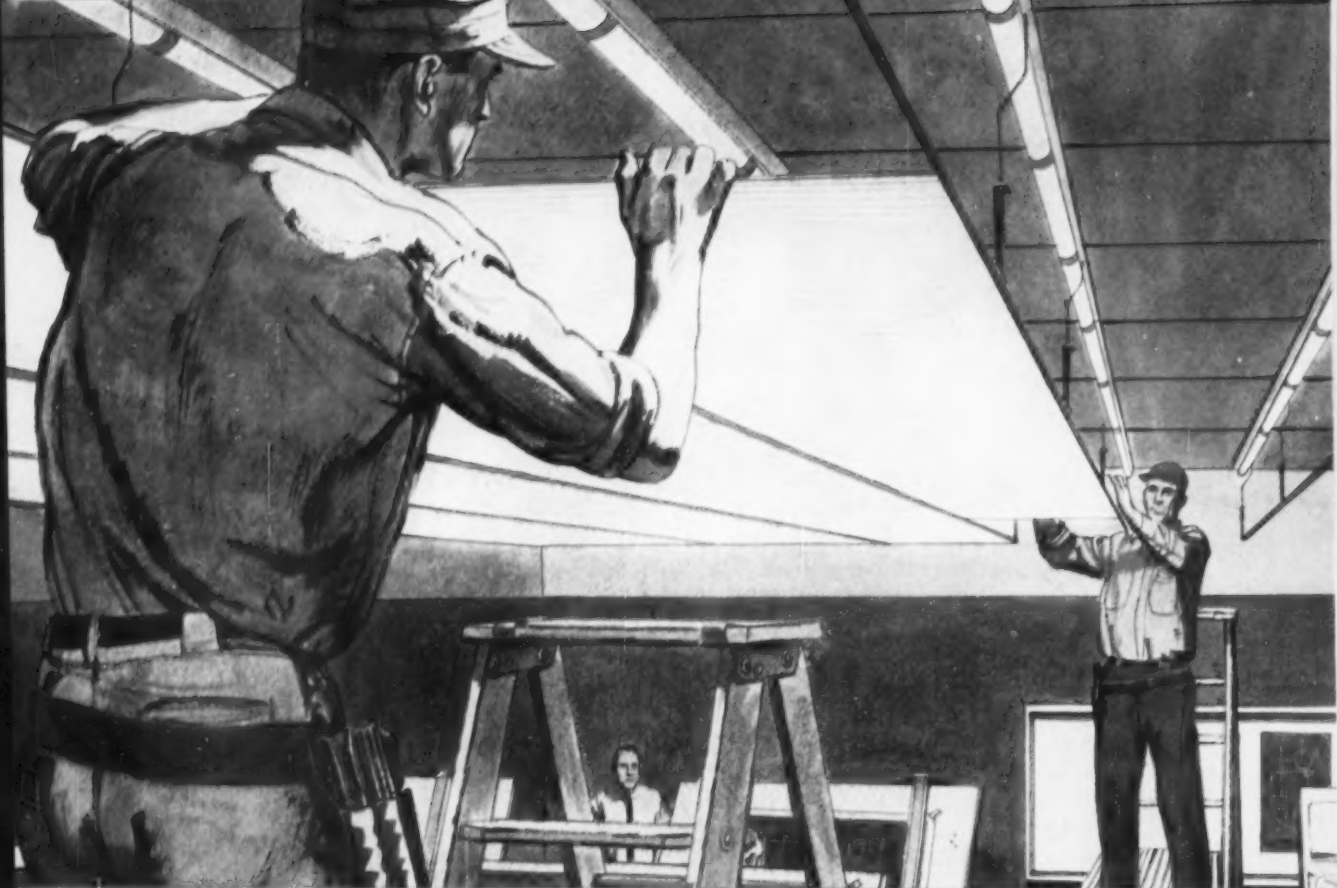
More subtle barriers at the present time to electric heating progress are erected by well-meaning professionals. Many architects, engineers, builders, even electrical contractors, are likely, on the basis of traditional industry attitudes, to dismiss electric heat arbitrarily and without investigation as "too expensive" or to damn it with faint praise and excessive caution.

Rapidly moving trends each year are more favorable to all electric and less favorable to fuel-fired systems. Ownership, custodial and maintenance costs; fuel vs. energy costs; thermal insulation technology; complementary air conditioning requirements; are among the changing factors that necessitate continuous reappraisal of practical projects in the light of up-to-date facts, present knowledge and, most importantly, public attitudes. For beyond objective analysis is always the intangible but powerful public preference for living better electrically.

To expect professionals generally to actively encourage electric heat at this time, is, perhaps, asking too much. They have acquired, over long practical experience, their own personal preferences for fuels and heating methods. They have every right to express these preferences constructively in advice, specifications or actual installations. The public, however, also has the right to be advised objectively and factually, from modern technical knowledge, and without gratuitous restraint, about electric heat. Then let the chips fall where they may!

Is electric heat too expensive? Let's give the customer a chance to decide—with all the facts before him—in the light of his own interests and his own values.

*Wm. T. Stuart*



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# OUTLOOK FOR 1957

Inherent in continuing economic growth are favorable factors for \$4 billion electrical construction and maintenance market:

- Construction up 5%
- Electric energy sales up 7½%
- Plant and equipment outlays up 7½%
- Electrical work up 7½%
- Record production of goods and services (GNP)

**E**LECTRICAL construction, installation and maintenance work will continue its upward trend during 1957. A rise of about 7½% is expected, which is a continuation of its historic pattern in recent years. Estimated gain last year was about 10% in dollar volume, reflecting both price increases and a gain of some 5% to 7% in physical volume.

Currently the healthy pace of construction, good prospects in appliance sales, and continued growth in electrical utilization, are all favorable factors pointing toward a \$4 billion total for electrical work in 1957. Tempering optimism, however, are the present realities of tight money and the limited supply of skilled electrical workers.

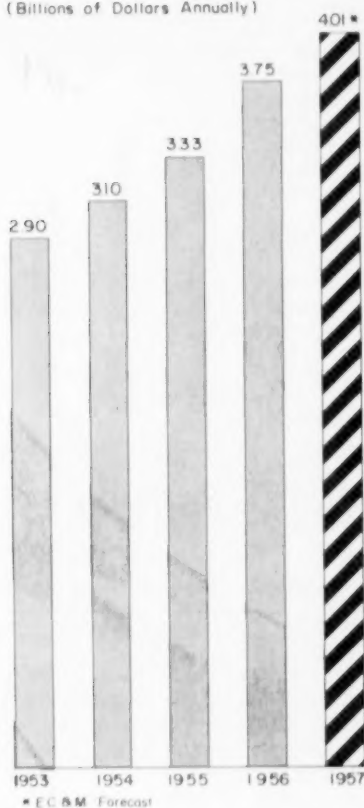
Of the new building dollar, electrical work continues to take an increasing share due to advancing utilization requirements and new electrically operated equipment. Higher standards of electrical ade-

quacy in residential work are bringing in a greater proportion of 100-amp and larger service equipments with a consequent increase in utilization outlets and circuitry. Commercial electrical system design is currently contemplating 100 footcandle and higher lighting loads and the heavy requirements of air conditioning. Industrial loads are increasing in drive horsepower and powered materials handling, as well as in lighting.

Emphasis is expected to continue in 1957 on the electrical modernization market. Pressure of load growth on existing electrical wiring systems is making otherwise useful buildings virtually obsolete. Minor modifications of the electrical system are no longer adequate or economical—they only aggravate the basic electrical capacity deficiency. Most old buildings today are in urgent need of complete rewiring.

**CHART I—ELECTRICAL  
CONSTRUCTION VOLUME**

(Billions of Dollars Annually)



The inadequate electrical capacity problem is most acute in the big cities where office buildings and apartment house utilization has grown far beyond the safe capacity of the systems originally installed. Several heavy current devices, notably the room or unit air conditioner, have brought the wiring problem to public attention.

Any downturn trends in electrical work due to downturns on specific types of new construction will be easily offset by the very large potential market in electrical modernization. In many large cities aggressive industry promotion (such as the national Certified Lighting program) is being devoted to electrical modernization opportunities.

Pressure of advancing lighting standards is influencing commercial modernization opportunities. Stores, particularly on main thoroughfares, are sensitive to lighting deficiency. Observers believe that

# TABLE I—ELECTRICAL WORK

(Millions of Dollars)

	1955	Est* 1956	Est* 1957
<b>PRIVATE FUNDS</b>			
Residential .....	705	670	661
Industrial .....	360	459	480
Commercial and Institutional .....	520	640	674
Farm .....	80	75	78
Utility .....	350	382	422
Other .....	6	6	6
<b>Total Private</b> .....	<b>2,021</b>	<b>2,232</b>	<b>2,321</b>
<b>PUBLIC FUNDS</b>			
Residential .....	5	7	11
Industrial .....	106	64	64
Educational .....	264	312	342
Institutional .....	36	38	45
Military .....	45	48	38
Highway, Conservation, Etc. ....	180	248	345
Other .....	35	38	42
<b>Total Public</b> .....	<b>671</b>	<b>755</b>	<b>887</b>
<b>Total New Work</b> .....	<b>2,692</b>	<b>2,987</b>	<b>3,208</b>
<b>MAINTENANCE AND REPAIR</b> .....	<b>640</b>	<b>760</b>	<b>800</b>
<b>Total</b> .....	<b>3,332</b>	<b>3,747</b>	<b>4,008</b>

\* Electrical Construction and Maintenance Estimates

an important new wave of modernization, at much higher lighting levels, is in the making.

A strong market for school lighting is continuing. A very large proportion of existing classrooms are presently lighted to intolerably low and obsolete standards. New schools in the current building program are providing sharp contrasts with existing facilities which, in turn, forces lighting modernization of older structures including re-wiring.

Last year major consumer promotion programs were devoted to residential wiring modernization. These included "Live Better—Electrically" and "Housepower". The impact of these programs should begin to be realized during 1957.

## Electrical Growth Trends

Several current developments are contributing toward advancing electrical system requirements, giving an industry growth pattern steeper than the general business outlook:

1. Advancing utilization standards are requiring more electrical work per unit of building area.

2. Lighting requirements are advancing on an exponential scale with resulting increase in all system components.

3. Widespread adoption of air conditioning is presenting new and much heavier electrical loads which must be accommodated by increased design standards.

4. Summer peaks as a result of air conditioning are stimulating interest in electric space heating.

5. Industrial power loads are increasing in hp per unit area for process as well as for materials handling. The versatility of electric heat is causing a new approach to traditional heating design criteria with higher energy costs often more than offset by other design advantages.

6. Industrial control is becoming more automatic and involves more elaborate equipment interconnections.

7. Appliance load growth both in numbers and in electrical loads of individual appliances is boosting the design capacity of wiring systems.

8. Growing complexity and extent of electrical systems are creating an expanding market for expert maintenance and repair services.

## New Building Construction

Expenditures for new construction this year are expected to rise some 5% over 1956's record \$44.1

billion volume, to an estimated \$46.4 billion. Last year's total was about 11% of the gross national product, reflecting the importance of this industry to the economy as a whole. New construction has ranged from a low of about 6% of GNP in 1946 to last year's record 11% during the postwar years and, in the opinion of most economists and barring an international crisis, seems destined to continue at this healthy pace for at least another decade.

Many of the new construction forecasts for 1957, made by various groups over the past couple of months, have also included a look ahead, long range, for another decade or more. All such forecasts are optimistic, and are based on what seem to be sound analyses. Our forecast, shown in detail in Table II, has been related by contrast with the record over the past ten years. This analysis reveals some interesting trends.

For example, the annual average increase for total new construction for the past decade is 26.8%. The increase predicted for 1957 over 1956 is 5%. The ten year annual average increase for private spending is 21.8%, compared with an increase of 2% during 1957 over last year's record. And the ten year annual average increase for public spending is 46.8%, compared with an increase of 12% for this year over last. Analysis of specific types of new construction on this basis can be very revealing and helpful to those doing work in specific fields.

This study points up clearly one revealing fact. That is that the "rate of growth" for new construction overall in 1957 as compared with the postwar period is slowing down. Also, it indicates this slowdown is greatest in the field of private spending, and that government spending is primarily responsible for the 1957 predicted increase over the 1956 record. Private spending, however, continues to account for roughly two-thirds of the total dollar volume.

**Residential**—Housing starts last year were down to 1.1 million from 1955's total of 1,328,900 or about 17.2%. This decline, measured numerically, resulted in demands for easier credit, government legislation, and other devices for market stimulation from builders and public housing adherents in and out of government.

But measured in dollars, expenditures dropped (Chart II) from 1955's record \$16,861,000,000 to only \$15,475,000,000, or about 8.2%. The higher dollar volume represents both a rise in cost of materials, and better quality houses. Builders and others point to population growth and the record of annual housing starts over recent years as a measure of the housing market, and demand easier credit and government assistance. Actually, this market depends more on new household formations, family income, and rate of replacement of older housing. In recent years household formations have averaged about 850,000 annually, and the trend is downward, with projections indicating an annual average of about 750,000 for the next three or four years. Thus the Depts. of Commerce and Labor's estimate of a market for one million new housing starts in 1957 is probably realistic of actual needs. There is good reason to expect residential electrical construction to increase per unit, and for 1957 volume to equal that of 1956.

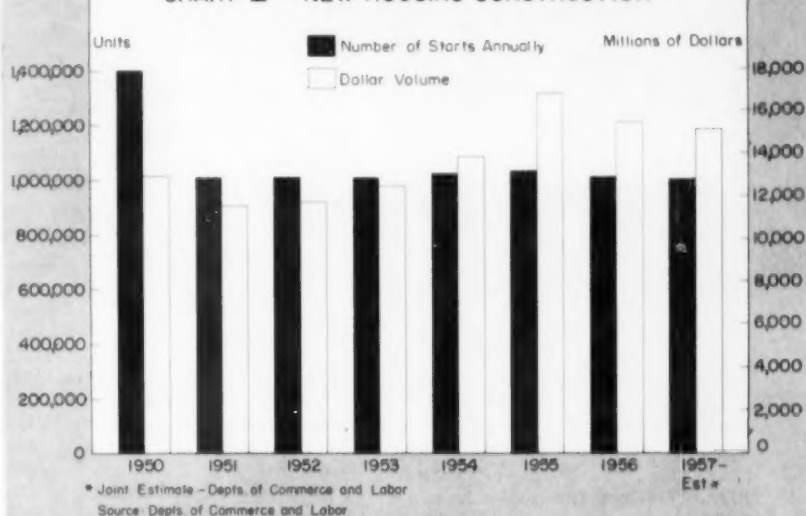
**Industrial**—Private industrial construction will continue to expand in 1957, but at a slower rate than during the past two years. This year's estimated \$3.2 billion volume will set a record—5% above last year, 33% over 1955 volume. Public industrial construction will continue at about last year's rate.

**Commercial**—Outlays for commercial buildings this year are estimated at \$3.3 billion. A decline in new stores and mercantile buildings is expected, which will be offset by an increase for office buildings. Declining contract awards and completion of many new shopping centers suggest that store-building demand is beginning to taper off.

**Educational**—Record expenditures of nearly \$2.9 billion for public school building, and \$550 million for private schools, appear likely for this year. The backlog demand now existing will push school construction far ahead of average construction over the next decade, but how fast this program begins to move will depend upon Congressional action for Federal aid, which is expected to receive full study by Congress for the next three or four months.

**Institutional**—Religious building, which has forged ahead for

### CHART II -- NEW HOUSING CONSTRUCTION



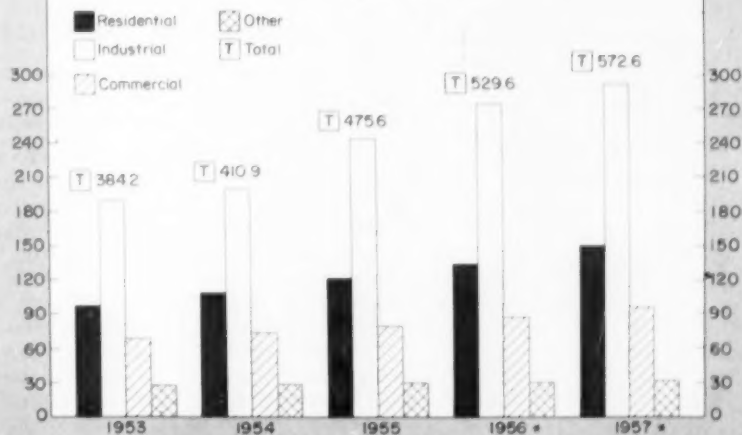
### CHART III EMPLOYMENT IN CONTRACT CONSTRUCTION

(Electrical Workers and Earnings)



### CHART IV -- ELECTRIC POWER SALES

(Billion Kwhr)



\*Electrical World Estimate

the past couple of years, will likely expand still more in 1957. A 13% increase is predicted. Public and private hospital building is also expected to forge ahead of last year by about 23%, after having declined slowly since 1954. Increasing Federal Aid funds will be an influencing factor.

**Public Utilities**—Announced expansion programs indicate expenditures of about \$4.75 billion on privately owned public utilities this year. Major gains will probably be for natural gas pipelines and electric power facilities construction. Depts. of Commerce and Labor have predicted.

**Military**—Construction work at military bases is scheduled for another moderate advance this year and will be at a postwar high. Outlays for public housing will show the first significant expansion since 1951, primarily because of the new Federal program of military (Capehart) housing under the National Housing Act.

**Highway**—A new record outlay for highway construction of about \$5.5 billion, or 8% above last year's record, has been predicted. This will be due principally to the expanding program of Federal aid to highways, just now beginning to get under way. An increasing percentage of the highway construction dollar is expected to go into lighting and electrical work.

### The National Economy

The business and economic outlook, in fields other than new construction and electrical construction and maintenance, is for a leveling off, but on a high plateau. The so-called tight money policy is slowing down the economy, as planned, which will help in attainment of our triple goals of economic growth, high level employment, and economic stability. Some economists have predicted that the second half of this year may retreat from last year's peaks. But others, and notably General Electric's president Ralph J. Cordiner, do not agree. They point out that "high level employment, rising expendable personal income, and a good all-around rate of construction" should keep the economy moving ahead.

Employment declined in November to 65.3 million, down 900,000

## TABLE II—NEW CONSTRUCTION ACTIVITY

(Millions of Dollars)

Type of Construction	1946	Est. 1956	Annual Average % Change 1946-1956	Est. 1957	% Change 1956-1957
Total New Construction	12,000	44,125	26.8	46,400	5
<b>PRIVATE CONSTRUCTION</b>					
Residential (excluding farm)	4,015	15,200	29.5	14,700	-3
New dwelling units	3,300	13,370	29.6	12,700	-5
Additions and alterations	570	1,385	14.3	1,500	8
Nonhousekeeping	145	445	20.7	500	12
Nonresidential building	3,341	8,800	16.4	9,275	5
Industrial	1,689	3,060	8.1	3,200	5
Office buildings and warehouses	331	1,365	31.3	1,500	10
Stores, restaurants and garages	801	1,935	14.2	1,800	-7
Other nonresidential building	520	2,440	36.9	2,775	14
Religious	76	775	92.0	875	13
Educational	123	535	33.5	550	3
Hospital and institutional	85	325	28.2	400	23
Social and recreational	125	270	11.6	300	11
Miscellaneous	111	535	38.2	650	21
Farm construction	856	1,500	7.5	1,550	3
Public utility	1,374	5,080	27.0	5,750	13
Railroad	258	435	6.8	450	3
Telephone and telegraph	305	970	21.8	1,075	11
Other public utility	811	3,675	35.3	4,225	15
Local transit	35	25	-2.9	25	..
Pipe line	63	350	45.6	375	7
Electric light and power	443	1,900	32.8	2,100	11
Gas	270	1,400	41.8	1,725	23
All other private	52	120	13.1	125	4
Total, private	9,638	30,700	21.8	31,400	2
<b>PUBLIC CONSTRUCTION</b>					
Residential	374	275	-2.6	450	64
Nonresidential building	354	4,050	104.2	4,500	11
Industrial	113	425	27.6	425	..
Educational	101	2,560	243.2	2,850	11
Hospital and institutional	85	305	25.9	375	23
Other nonresidential building	55	760	128.3	850	12
Military facilities	188	1,420	65.7	1,525	7
Highway	895	5,100	47.1	5,500	8
Sewer and water	194	1,290	56.5	1,550	20
Public service enterprises	99	450	35.5	475	6
Conservation and development	240	660	17.5	800	21
All other public	18	180	90.0	200	11
Total, public	2,362	13,425	46.8	15,000	12

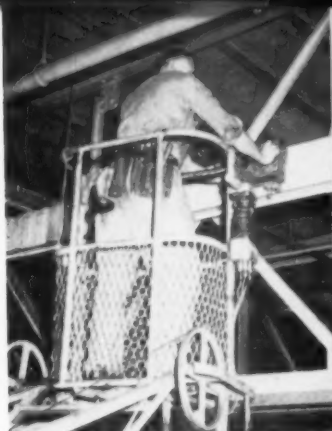
Source: Depts. of Commerce and Labor.

Note: 1956 estimate and 1957 forecast prepared in mid-November 1956.

from the all-time high of 66.2 million in September and October. It was still at a record level for the month. Non-farm employment was 1,200,000 over the year earlier total. Gross national product for 1957 is predicted at \$425 to 435 billion, part of which will reflect price increases. Personal income at last year's end was at annual rate of about \$335 billions, up 5%

over a year earlier. Population has passed the 168 million mark, and continues upward at rate of about 1.6% annually. The FRB index of industrial production at end of 1956 was 145, and is expected to hold this level through 1957. The BLS consumer price index in December was estimated at 117.5 and expected to rise slowly through 1957 to 119 at year end.





*50 Experience-backed questions and answers about . . .*



# INDUSTRIAL ELECTRICAL MAINTENANCE



**Organization, Objectives, Scope  
Budgets, Cost Formulae, Controls  
Personnel Selection, Training, Supervision  
Transformers, Switchgear  
Motors, Brushes, Commutators  
Inventories, Checklists, Schedules  
Records, Reports, Paper Work  
Specifying and Checking New Equipment**

**E**LECTRICAL maintenance is a partner of production—a partner contributing with management, engineering and sales to industry's overall success. As the importance of industrial electrical maintenance grows, so too does the number of questions which we hear from men responsible for this essential service. These questions are searching in content, specific in nature, indicating a desire to know why and what and when and how.

To obtain practical answers to these questions, the editors of EC&M have visited plants from

coast to coast, talked with maintenance men from the top of the ladder to the bottom, and contacted numerous men who have appeared as authoritative spokesmen for industry on various Plant Maintenance Conference programs in the past. Answers, therefore, go beyond the theoretical and are backed by a wealth of practical experience that reflects a broad cross-section of industrial electrical maintenance know-how.

On the following pages we present half a hundred of these questions selected for general interest and help to our readers.





**MAINTENANCE** of sealed ignitron mercury-arc rectifiers, close-coupled with transformer and switchgear, insures continuity of low cost dc power. Modern maintenance requirements also include service of . . .



**CONTROL** equipment, such as this assembly for regulating electric furnaces in large production plant. Note use of metering devices and protective goggles. Scope of industrial electrical preventive maintenance likewise covers . . .



**DISTRIBUTION** mediums, as typified by this tap box wherein two 480-v plug-in busducts, mounted at truss level, are center-fed from a low-reactance ventilated bus installation through twin breaker adapters.

## INDUSTRIAL ELECTRICAL MAINTENANCE:

### *Organization, Objectives, Scope*

**When a faulty condition is reported by the production department, should it receive priority consideration over normal maintenance work?**

Bonafide emergencies should of course receive prompt attention, but disrupting normal routines to correct minor faults is neither recommended nor desirable if these faults can safely be deferred until a scheduled shutdown of equipment occurs. Intelligent deferment of some work also creates a slight maintenance backlog which is desirable, for it provides fill-in work for valleys between work peaks, thereby evening out the activity of the maintenance force and utilizing manpower more effectively. Therefore the importance of a fault should be determined by inspection and judgment of the maintenance supervisor, and the priority it receives should depend upon a meeting-of-the-minds with production managers.

**What are the objectives of maintenance?**

The goal of every industrial plant

is high output, safety, quality control and good labor relations, with overall manufacturing costs kept within reasonable limits. Maintenance can further this objective in several ways, such as by (1) preventing or reducing productive downtime, since interruptions cause direct losses, require subsequent overtime premiums and boost indirect costs of the end product, (2) by preventing abnormal physical depreciation of equipment, since excessive replacements or standby equipment affects overhead charges and capitalization, (3) by preventing fires and safety hazards, since these result in increased insurance costs, labor turnover, unanticipated shutdowns and losses, poor labor and public relations, and (4) by keeping maintenance charges as low as possible while yet obtaining the supervision, organization, training, safety and quality control that the service demands.

**In setting up a maintenance organization, what requirements should be considered?**

Considering physical requirements first, there must be supervision and a manpower force commensurate

with the size and type of the plant, with the knowledge and skill to intelligently analyze and correct all possible electrical problems. There must also be an adequate stock of replacement parts, proper tools and equipment to do the work, means for handling and moving materials and equipment, efficient transportation and communication for employees, historical records and reports to check past performance, and budgets and cost accounts for financial interpretation.

**What are the arguments for and against a zone maintenance organization as opposed to a centralized department?**

In extensive plants and under conditions of concentrated production there are many arguments to recommend area maintenance, with crib crews working in specific localities throughout the plant or in different buildings. These crews have their own tools, spare parts and sufficient materials to handle all normal maintenance and minor repairs.

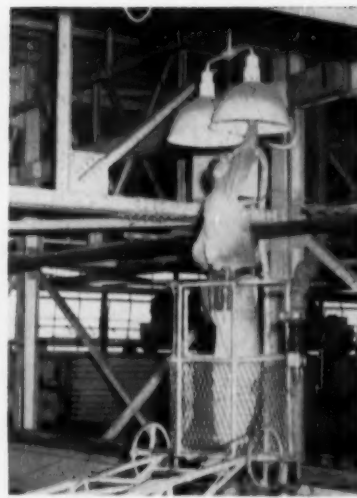
On the other hand, each separate



**MODERN** equipment can greatly improve efficiency of maintenance department, as indicated by this 2-way radio-telephone that maintains instant communication between electrician stationed in control room and his . . .



**PARTNER**, who may be trouble shooting for motor faults on the main production floor, as this one is doing. Portable transmitter-receiver hook-up keeps men in contact while they discuss course of action.



**SPECIAL** equipment that facilitates maintenance work can also take the form of elevating platforms that lift and move men for such high-bay jobs as relamping or fixture cleaning. Note controls mounted on basket.

crew has to have its own leader, thereby increasing the ratio of supervisors to workers, and it also frequently leads to duplication of equipment and division of responsibility. For these reasons the recent trend has been towards maintenance departments that are centralized in both organization and location.

Emphasis should be placed on the central location, however, for placing the department in an out-of-the-way spot is penny wise, pound foolish. While it is true that out-of-the-way spots are generally lower-cost areas, the inaccessibility generally boosts overall maintenance charges by increasing travel time and, as a result, lengthening the periods of production downtime when breakdowns occur.

**Recognizing maintenance as a partner of production sounds like a pleasant dream; but why is it necessarily important?**

Responsibility without authority can only result in confusion, and, when recommendations of trained technicians can be ignored or coun-

termanded by those unfamiliar with the technical problems involved, performance standards are bound to suffer. Admittedly, it is often difficult to obtain the release of electrical equipment for minor repairs and inspections. However, if maintenance is to be thus minimized, the responsibility for later breakdowns should not be dropped on the doorstep of the maintenance department. Only by considering production and maintenance on an equal basis—relating the cost of a planned shutdown to that of a possible subsequent breakdown with resulting losses of manhours and production—can management determine overall policy intelligently.

**What is the scope of responsibility of an industrial electrical maintenance department?**

In general, the department is responsible for the maintenance of all components in the electrical distribution system, plus all machines and devices served by it. This would cover transformers, switchgear, controls, distribution mediums,

lighting systems, motors, cranes and conveyors, heating equipment, communications systems and the like.

**Should the electrical maintenance department also be responsible for electronic equipment?**

That depends upon the size of plant, also upon the number and type of electronic controls under consideration. With few such controls, a plant could profitably rely upon service supplied by the manufacturer or an independent service organization specializing in this field; although, if the instruments are simple ones, maintenance could possibly be handled by a plant electrician.

If electronic devices are numerous and complicated, however, it is generally advisable to have one or more men specially trained for this assignment, having them report directly to the head of the maintenance department rather than to a foreman. Whenever the size of a plant warrants, specialization results in faster, more proficient and more positive results.

### *Personnel Selection, Training, Supervision*



**TRAINING** programs should include instruction in the use, purpose, application and interpretation of data obtained with the aid of indicating and recording instruments; and all maintenance men should keep up to date on current electrical trends, methods and equipment by reading technical trade, association and manufacturers' magazines and literature.



**BASIC** training should also promote maximum use of time-and-energy-saving power tools, such as this electric impact unit equipped with spindle socket to remove motor end-shield cap screws.



**WIRING** diagrams should be referred to repeatedly, until the maintenance man has obtained a thorough understanding of the equipment he is responsible for and the circuiting related to this equipment.



**STABILITY** under pressure, ability to express himself clearly and effectively, knowledge of overall management policies and procedures, skill in human relations, a background of experience and technical knowledge and the ability to analyze problems, make decisions and institute prompt corrective action are essential attributes for an electrical maintenance supervisor.

### **On what basis do you select men for supervisory jobs?**

A supervisor or foreman should have skill in human relations, adequate education and experience, knowledge of management policies and procedures, effectiveness of judgment, ability to plan and organize work, ability to make decisions and take action, personal stability especially under pressure, ability to express himself orally and in writing, ability to inspire confidence and loyalty of others, ability to improve methods, ability to manage materials and machines, and, of course, good health.

### **How extensive is the responsibility of a maintenance supervisor?**

In addition to setting up maintenance operations, inspection schedules and historical records, he has the responsibility for estimating electrical demands, cost and construction so that the plant engineer can intelligently plan future budgets and requirements. He should keep himself informed concerning new equipment on the market, and, where such knowledge would benefit the operations or efficiency of his own plant, make such recommendations as necessary to management.

### **What is the ideal ratio between maintenance supervisors and the actual number of working electricians?**

At a recent Plant Maintenance Conference this question was asked of several hundred delegates. Answers ran from 1-to-8 to 1-to-30; the average being 1:19. However, it was agreed that much depends upon local conditions, such as whether or not plant maintenance is zoned or centralized, or whether maintenance work is of a general or specialized nature.

**In small plants, where electrical maintenance work would not occupy the full time of an electrician, couldn't manpower be conserved by classifying electrical maintenance with general janitorial service and having this combined assignment handled by a jack-of-all-trades handy man?**

This practice would be short-

sighted on two counts. First, it would tend to drive capable men away from the maintenance field and, second, it would retard the development and use of electrical equipment. Many manufacturers are already finding it difficult to sell new, improved products to companies that assert they have nobody capable of installing or maintaining them. In such cases, the cost of service (by the manufacturer) could exceed the profit on a sale, thereby eliminating the incentive for making the sale. This decreases a manufacturer's sales potential, but it also indirectly hurts the lost customer, for that company is thereby deprived of the benefits which originally prompted and justified the development of the improved electrical product.

### **How do you select and train maintenance apprentices?**

Prospective apprentices should have high school education, sound physical health and be at least 18 years old. In addition, however, many large companies now have training programs of their own, combining classroom instruction with actual shop work and field training under the supervision of experienced men.

On the theory that the purpose of any training program is to bring a man and a job together in a manner which will result in the greatest benefit to both the trainee and the company employing him, some companies have included "provisional" periods during which time a trainee either demonstrates his ability and interest in the work, or he is dropped or transferred to another department. Those who qualify for further training subsequently undergo a rather lengthy and intensive apprentice course that combines theoretical with practical training, and generally concludes with the presentation of a journeyman's certificate.

These courses include training in motor repair, construction and telephone work, general electrical repair and control work. Classroom study also includes mathematics, algebra, trigonometry, physics, engineering drawing, mechanics, English, materials and shop theory. Good prospects are permitted to specialize in many instances, and additional assignments provide opportunities to obtain broader ex-

perience. Trainees are graded every few months, and wage advancements are determined under a merit system that considers classroom work, productive ability, plus various personal attributes as well. Other ways to combine skill with knowledge is through the mediums of lectures, conferences, case studies, books, trade magazines and manufacturers' literature.

This intensive training is considered necessary because of the growing complexity of the electrical maintenance field. And, with this training as a springboard, a large percentage of apprentice graduates now continue upwards to positions above the grade of journeyman, in many cases going to supervisory positions as high as plant managers.

### **How much clerical help should a maintenance department employ?**

As in the case of a preceding question, this will be influenced by the size, nature and complexity of the maintenance organization and its responsibilities. However, the average industrial plant in the country employs one clerical worker for approximately 20 employees in the maintenance department, although variations exist between the limits of 1:10 and 1:50.

### **In a maintenance organization, which is more important: a good over-all plan of operation, or good workers?**

Any plan of operation, if carried out by qualified personnel, will produce some beneficial results. Conversely, even the best of plans can fail if good men are not available. This is not intended to minimize the importance of a good, basic organization plan, but it does stress the importance and value of employing capable men who, under the supervision of foremen, actually make the tests, inspections and repairs, then analyze and report their findings. Upon their knowledge, aptitude and conscientiousness depend the efficiency and safety of the entire electrical system. As to the organization of these men, they may be divided into plant, crib or emergency crews, or they may be specialists working on specific assignments so that trouble can be diagnosed and corrected as quickly as possible.





**COSTS** of maintenance can be reduced by improving methods or adopting special equipment to simplify routine procedures, such as this brush-tank unit that greatly speeds cleaning of cellular louvers of fluorescent lighting fixtures.



**TRANSPORTATION** of men and materials around large plants can also be speeded up to conserve time and energy, thereby increasing productiveness and efficiency. Here a bicycle supplies a simple answer to this recurrent problem.

## INDUSTRIAL ELECTRICAL MAINTENANCE:

# *Budgets, Cost Formulae and Controls*

**In cases where previous cost records and experience are lacking, how can a maintenance supervisor establish an intelligent budget?**

It is true that close estimates of contemplated costs depend upon experience and past records. However, where such aids do not exist, several assumptions, or "educated guesses" can be made by making a thorough survey of the plant, equipment and distribution system. Existing conditions of equipment, availability and accessibility for making repairs, etc., can then determine what should be maintained and to what extent.

The resulting schedule and budget will only be an approximation (which fact should be drawn to the attention of management), but it should provide a rough standard to base a budget upon, until such time as more specific experience and data are compiled.

**What is meant by "non-maintenance" functions?**

Many plants define an electrical maintenance department as a "gen-

eral service" organization and, as a result, make it responsible for (1) construction of new facilities, (2) modification of old facilities, (3) experimental work, (4) receiving, shipping and handling materials, (5) operation of other departments, such as steam or power, or even (6) plant protection. Many of these functions have little direct relation to the defined definition of maintenance; that is, to "keeping existing facilities in condition to function with their designed efficiency". Until maintenance is charged *only* with maintenance functions, plant-to-plant variations are bound to exist, making comparisons inconclusive.

**How can a maintenance supervisor trim his operating expenses?**

Costs can be reduced in two ways: by doing less work, or by doing it more efficiently. This does not mean to imply that *essential* work should be neglected, skimmed or performed in a ship-shod manner. It is possible, however, to eliminate *unnecessary* work in quite a few instances.

Routine jobs should therefore be reviewed and challenged periodically, for conditions that made the jobs necessary originally may have changed, new tools may have come into acceptance, or new methods may be dictated by greater experience or training.

Then, assuming that the amount of necessary work has been reduced to an absolute minimum, costs can be reduced still further by improving the design of equipment, reducing the abuse of equipment, taking preventive measures to detect and correct minor faults before they become serious. Better planning and scheduling can improve manpower utilization, minimize confusion and permit personnel to spend more time productively. Methods can be improved by using better tools, applying improved procedures, or reducing non-productive effort. Productivity of workers can also be stimulated by incentive pay, or by raising basic pay rates and basic work standards simultaneously. Experience shows that this latter approach improves departmental morale as well as generally improving the quality of the work being performed.



**INTERPLANT** non-productive travel can also be lessened by improving communications between outlying areas. Here is a sound-shielding, covered, 2-way intercom station located near a local transformer in a large outdoor storage area.



**AUTOMATIC** opening of doors, by means of photocell monitors that motivate operation when their light beams are interrupted, is still another method by which plant efficiency can be improved with properly maintained equipment.

### Why do many maintenance charges vary so widely in plants of similar size and type?

Even in industrial factories where maintenance operations should be fairly comparable, the chances are that bookkeeping methods are dissimilar, or that many non-maintenance functions are included in the maintenance budget.

**Couldn't some cost formula for industrial electrical maintenance be developed, on the basis of total kwh consumption, machine tool productivity, total floor area served, production output, total tonnage or sales dollar volume?**

All of these standards are in use at present to varying degrees and, in many instances, their fluctuations are closely proportional to related maintenance requirements. There are so many other variables, however, that plant-to-plant comparison by strict formula would be extremely misleading. For example, many plants have engineering and

research laboratories, service areas, warehouses and office space in addition to their production departments. These related facilities require continued maintenance, regardless of fluctuations in production quotas. Budgets in individual plants can profitably consider all related factors, but they should not be completely dependent upon or governed by them.

### How do you determine the amount of money to be allocated for electrical maintenance in a specific industrial plant?

This is largely a matter of experience and judgment, and few industrial managers would attempt to place an inflexible dollars-and-cents limit on its worth. Of course we know that equipment will eventually wear out and fail if adequate attention is not given to it. Therefore, over a period of years, most companies have progressed from the outdated practice of waiting for failures to the modern practice of systematic checkups designed to detect minor troubles before a breakdown or fault occurs to damage

equipment or to interrupt electrical service.

We know that this intelligent preventive maintenance approach reduces production losses, but the actual economic investment that produces the maximum overall return must depend upon the experience and judgment of the men responsible for specific assignments.

Where younger men do not yet have the necessary experience and judgment, they may be guided to a large extent by detailed checklists which should serve as a reminder until various procedures become automatic. Checklists should be conveniently posted for reference, for relying upon memory completely is neither recommended nor desirable when the electrical equipment being maintained is complex or expensive.

Maintenance, of course, should be concerned with uninterrupted operation of equipment, and with prompt repair of a fault should it occur. However, maintenance should not stop with the repair but should also include an investigation to determine the *reason* for the fault so that the *cause* can be eliminated.



**MOTOR** cards should list nameplate data and pertinent information concerning coils, bearings, couplings, brakes, controls, brushes, nature and dates of former repairs, application of unit, mounting dimensions, etc.



**INDEX** of electrical equipment in large industrial plants frequently necessitates use of extensive card file, such as the above. Basic information is recorded to take guesswork out of maintenance decisions.

## INDUSTRIAL ELECTRICAL MAINTENANCE:

### *Records, Reports, Paper Work*

#### **Why is the keeping of records emphasized so strongly?**

A maintenance department must have considerable basic information constantly available and constantly accurate to provide an effective guide for action. With the complexity of modern electrical equipment in use this would be impossible if we depended upon memory alone. Historic data, specifications and drawings should therefore be filed (1) for reference, (2) to provide effective inventory control, (3) to intelligently analyze operating characteristics, and (4) to alert the maintenance department to signs indicating the need for preventive action. Records also (5) provide checks and guides for corrective procedures and the results of same.

Since most maintenance departments recognize the necessity for a certain amount of paper work, yet want to limit and simplify it as much as possible, what would you consider to be absolute minimum essentials?

As a minimum, records, reports and orders should answer four questions: (1) what work was or is to be done, (2) when, (3) how, and (4) for how much time and money. This information can be contained under two basic categories of paper work: (1) equipment service record cards, indicating routine maintenance requirements, maintenance and repair records, with parts and hours shown, and (2) maintenance work orders, written against service record cards, or shop repair requests describing work and recording time and cost data; this information to be transferred subsequently to the service record cards. These records will provide minimum supervision, indicate requirements for maintenance and show where improvements are necessary to prevent recurrent breakdowns.

#### **In addition to these minimums, what other types of records are recommended, and why?**

Of almost equal importance to service record cards and maintenance work orders is a complete identi-

cation of equipment and accessory parts, with necessary identification numbers; a list of drawings, catalogs and other data pertaining to equipment, with an index to locate them in the files; tabulation and indicated locations of all electrical equipment in the plant; complete service and maintenance requirements of that equipment; a schedule of when these operations are to be performed; plus a maintenance and repair record to show the cost involved over the year. This implies considerable paper work. Yet, without it, it would be extremely improbable that manpower could be used efficiently, spare-parts inventory controlled, equipment kept in efficient service for a long lifespan, or breakdowns forestalled before costly repairs or production shutdowns become necessary.

#### **What information should be included on motor data sheets?**

Motor data sheets are kept to insure the use of correct parts, detect patterns of recurrent trouble, and to lessen the guesswork in maintaining prime movers. Therefore per-

tinent information concerning drive bearings, couplings, brakes, controls and the like should be included, together with serial numbers and nameplate data. If properly indexed by drive and motor type, these data sheets can provide prompt and accurate information whenever re-ordering, modifying or rebuilding is necessary. Also important is the recording of brush data so that manufacturers' recommendations can be duplicated exactly.

For fast reference purposes, many companies assign their own code letters or numbers to armatures and frames. By listing dates the motors were placed in service, removed, repaired (with the nature of the work listed), or transferred, facts can be determined concerning the correct application of a unit, reasons for recurrent failure, needed improvements in motor design or shop-work techniques, comparisons of different types, and so on. All of this information leads to better motor performance and thus attains one of many maintenance objectives. These motor histories, recorded and filed on separate cards, provide invaluable finger-tip information. Careful analysis of these cards frequently reveals patterns of repetitive faults, suggesting revisions in the scope of maintenance practices, changes in motor applications or alterations of control methods, and helping to pinpoint improper operating conditions or faulty materials.

#### Are there any proved techniques or "gimmicks" to follow in preparing and submitting reports to management?

Most reports are similar to sales talks, in that they should attract attention, create interest and desire, then suggest a course of action. Of course, there are various approaches to this formula. For example, some people follow the "newspaper" technique of telling what, when, why and how in the first paragraph or in an opening abstract. Other maintenance men follow the procedure of stating an existing condition, telling what is wrong with it, how it could be improved, and what savings or efficiencies would result. Other plants have prepared printed forms so that report writers will not forget the important points such as a title, the proposal, reasons, benefits and

cost. Any of these approaches can be effective.

It should be remembered, however, that management is primarily interested in justification and results, so reports can be improved by emphasizing these points. Consider, for example, two electricians, one of whom tells the boss, "My back is breaking, so how about a conduit threader". The other says, "With an electric threader I could do twice as much work in the same time, thereby increasing your output". In other words, the second

electrician is putting himself in the boss' shoes and is preparing his report in terms that he knows management is interested in, that is, in tangible returns on an investment. It is also helpful to remember that any report provides an opportunity to promote yourself, as well as to sell an idea, because a report can reveal your sincerity, your intentions and your logical collection and analysis of data, just as plainly as your voice, your gestures and your language can in a face-to-face conversation.



**FAST** reference to any type of maintenance information can be promoted by recessing rotating card files into desk top. Colored tabs moved along card borders provide general guide system for rapid visual check.



**WIRING** plans eliminate confusion and uncertainty when identifying feeders, sub-feeders and branch circuits for test purposes, for revamping or extension of a system, and for making intelligent system surveys.





**PERPETUAL** inventory cards identify stock items; show dates and quantities of parts delivered, withdrawn and remaining in stock; indicate vendors, previous unit list and net prices; approximate rate of depletion and note quantity level where re-ordering is necessary.



**FILES** containing all pertinent data related to specification, construction, installation, operation and maintenance of electrical devices and materials are also of definite value to plant engineers and purchasing agents. Files cover desired as well as already-installed items.

## INDUSTRIAL ELECTRICAL MAINTENANCE:

### *Inventories, Purchasing, Scheduling*

#### **Why should warranties be considered when re-ordering some replacement parts for inventory?**

Due to conditions related to the warranty of certain products (such as high-priced vacuum tubes having warranties for only a few months, days or even hours), these items should be delivered to a plant only when the need for same becomes imminent. That is because warranties of this type begin at the time the products leave the vendor's premises, and following this ordering procedure greatly lessens the possibility of a maintenance department storing the item for a lengthy period, then eventually using a tube which, although "new", is no longer within the warranty period.

To insure prompt availability of these items when they are actually needed, the items should be ordered as soon as they become low in plant inventory. Yet, to take full (and legitimate) advantage of warranty protection, the vendor should be

requested to withhold actual shipment until subsequently directed to do so by the industrial customer's purchasing agent.

#### **Can inventory investment be reduced through the practice of standardization?**

Definitely yes! This applies to spare parts, replacement motors, cables or electronic control tubes alike. For example, feeder cables could be limited to two or three sizes and, where additional capacity is required, these basic sizes could be paralleled. Also, with electronic applications constantly multiplying (with each manufacturer giving various numbers, prefixes and suffixes to tubes with identical or similar characteristics), it would be quite possible for a maintenance man to requisition the purchase of additional new tubes, although acceptable substitutes might already be available in stock.

This possibility would be lessened by compiling a cross-indexed listing

of variously identified but similarly constructed tubes. These practices of standardization, cross-indexing and inventory reduction have numerous advantages, because capital funds for inventories are released for investment in other channels, storage space is released for production purposes, maintenance procedures are simplified, and the possibilities for obsolescence, deterioration, breakage and pilferage are greatly lessened as well.

#### **How would you set up an inventory control system?**

Good preventive maintenance demands that replacement parts be on hand when needed, yet maintaining an excessive number of parts will mean that space and money are wastefully tied up. To strike the optimum between these two extremes, a perpetual inventory should be set up, basically showing quantities and dates of all deliveries, with withdrawals, running residual quantities remaining in

stock, when and how much to reorder when stock reaches a predetermined minimum level.

Inventory quantities, when and how much to order are all dictated or influenced by experience, so must be worked out separately for each plant. Only by determining and maintaining these limits can waste be eliminated while keeping adequate replacements available.

#### **How can the "mechanics" of ordering and issuing maintenance materials be speeded up?**

In purchasing replacement parts, accuracy and speed can be furthered by having available a listing of catalog numbers, suppliers to contact, their phone numbers, prices and discounts, delivery times, guarantees and warranty information. In large stockrooms it is also helpful to have an index that relates parts to bins or storage locations for fast check-ups or obtaining of required parts.

#### **What determines the frequency and extent of maintenance routines?**

This is a controversial question and there is no stock answer, for there are many systems in practice that fall between the extremes of the "fireman" and "milkman" techniques; that is, between the per-

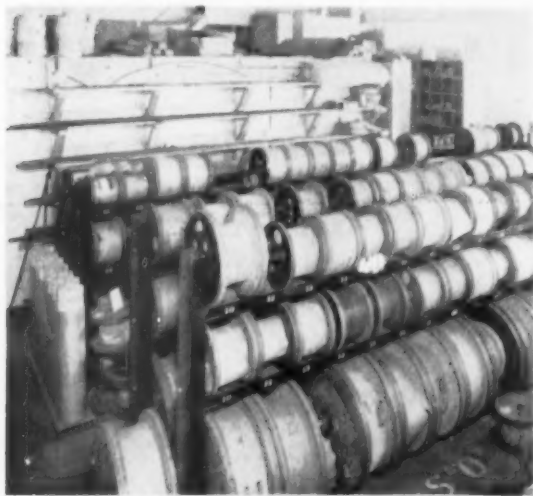
formance of a service after an emergency has arisen, and performing it before it is apparently required. One could say, however, that both frequency and extent of maintenance should be based upon (1) research of past failures of equipment; their frequency, seriousness and the total loss resulting from those failures, (2) analysis of the cause of trouble, such as friction, fatigue, stress, corrosion, misalignment, vibration, poor adjustment or bad housekeeping, (3) hazards connected with failure, (4) operating conditions of the equipment, (5) hours of use per day, week or month, and (6) educated guesses, based on the above, as to the expected deterioration or failure of equipment if appropriate corrective action is not taken.

As a minimum, we know that some items do not justify any maintenance at all, particularly if maintenance cost is balanced against rated depreciation, obsolescence or replacement values. The upper limit will be determined by analyzing overall cost reports, because increasing maintenance will eventually reach a point of diminishing returns. Just where the break-even point comes must be decided separately for each plant, each machine or each item of equipment. In scheduling inspections, however, sufficient time should be allowed for making visual checks, cleaning and lubricating parts, listening for un-

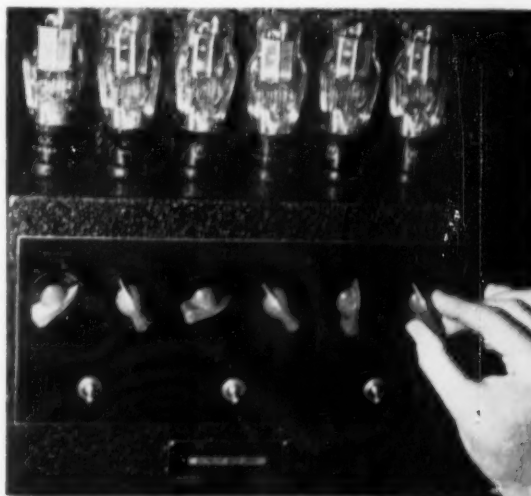
usual sounds during operating, manually feeling motors and bearings for unusual heat, etc. Schedules should also be viewed periodically so that original recommendations can be adjusted in accordance with subsequent experience of changes in operating conditions.

#### **What are the advantages of a maintenance supervisor studying, planning and scheduling a job, rather than just assigning the work to a competent electrician and letting him work out the details for himself?**

Many times a worker, if left on his own, does work in a more elaborate manner than actually necessary, or he uses more expensive materials than are needed, or he gets part way through a job then has to wait for the foreman to come along and tell him how to finish it. Planning and scheduling, however, forces a foreman or supervisor to make a study to determine the best method, the best tool or equipment, and the best material to use. Time spent by a competent supervisor in analyzing the work is bound to pay dividends in the end. Recommended procedures, based upon study, analysis and experience, should therefore be followed to obtain standardized, reliable, economically practical results.



**STANDARDIZATION** can result in smaller inventories with resultant reductions in storage space, capital investment and the like. Stock of wire and cable could therefore be limited to a few sizes, with parallel feeders installed where additional capacity is required.



**WARRANTIES** on certain products, such as costly vacuum tubes, are frequently of short duration, going into effect on date of delivery to the customer. Ordering when supplies are low, but requesting delivery only when actual use is imminent, has obvious advantages.

## INDUSTRIAL ELECTRICAL MAINTENANCE:

# Motors, Brushes, Commutators

### Why is cleanliness stressed so strongly in relation to motor maintenance?

The word "cleanliness" is an all-inclusive term referring to the elimination of dust, dirt, oil, grease and moisture. Each of these elements attacks insulation in a different manner. For example, accumulations of dust and dirt hasten deterioration because heat radiation is restricted, permitting materials to dry out more rapidly. Dirt may also include particles of such destructive agents as acids, alkalis or metal. Lubricating oils and grease have tendencies to dissolve certain compounds in ordinary insulating varnishes. And moisture, combining with the other foreign agents, contributes to the formation of gum, further restricting heat dissipation.

### What are some recommended methods for keeping motor windings clean?

To remove usual accumulations of dust and dirt, general practice is

to use dry compressed air, the frequency of blowing being determined by the environment in which the machine operates. Blowing should be used with discretion, however, because excessive air pressure can drive foreign particles deeper into the windings. This is especially harmful if the particles are powdered or atomized metal. In cases such as these, it would be better to dismantle the machine, perhaps annually, and wash out the accumulations with a suitable solvent.

As to excessive oils and grease: this develops primarily from carelessness, and, again, these accumulations should be removed by using solvents designed for that purpose, and the windings thoroughly dried before returning the motor to service. Usually, the cleaning of small machines can be accomplished with the aid of a hand spray, brushes and rags. It should be remembered, however, that solvents may soften the varnish, so subsequent dipping and baking may be necessary. In cleaning larger machines, many maintenance men recommend the use of ground corn-

cobs under pressure, since the cobs not only polish off the accumulations but absorb any oil that may be present.

As to the elimination of moisture: air circulation, low humidity and heat should accomplish this objective and, towards this end, large motors can be equipped with strip heaters that are placed in operation when the motors are shut down for any length of time.

### How frequently should motors be inspected?

This depends upon hours of service, operating conditions and resulting seriousness of outages. For example, in one large photochemical plant where over 10,000 motors are related to exact temperature and humidity conditions, some pump motors are checked as frequently as three times daily. This is an unusual condition, but it was found to be justified insurance in view of the critical processes involved. In fact, this inspection schedule has kept rewinding jobs below 1% per year, while many minor troubles have been discovered and corrected before an outage developed.

### Is a visual and manual check sufficient to detect moisture and accumulations of foreign matter in motor windings?

Under many conditions visual checking is sufficient, but the use of a megohmmeter is recommended for testing insulation resistance. By taking and comparing readings at definite intervals, the presence of moisture and the progress of internal deterioration of insulation can be ascertained.

Of course, a zero reading would indicate a ground, caused by either a complete insulation breakdown at some point or, at any rate, a contact between a conductor in the circuit and the ground or frame of the machine. Even if the megohmmeter reading is apparently high enough to indicate safety, the fact that it may have dropped considerably from a former reading could mean that windings require attention.



**PORTABLE** hand-cranked Megger is reliable instrument for checking resistance readings in the field. Even when a reading is apparently satisfactory, a drop from a former recording could indicate that deterioration is in progress.

### How can motors be cleaned in place?

Compressed air or non-flammable solvents may be used for this purpose, and motor bearings can also be flushed.

### Would motor maintenance be simplified by standardizing on high-temperature insulation?

Many people believe that motors could be built at a fraction of their present cost and size if high-temperature insulation was universally used and motors were thereby permitted to operate with temperatures ranging up to several hundred degrees C. This might be true, but it is also probable that bearings and lubricants would deteriorate more quickly.

There are, of course, numerous instances where high ambient temperatures cannot be avoided, or where absolute minimum size is of the utmost importance. In these cases, high-temperature insulation has a definite advantage.

Where these conditions are not present, however, "old fashioned" Class A 40-degree C insulation will probably be cheaper and easier to maintain in the long run. Under normal conditions, Class A will give long life, rugged service, low replacement cost, easy maintenance, resistance to moisture and vibration. It is also easy to handle, clean, dry and dip. This is another instance where local conditions should dictate the selection of Class A, B or H insulation, for each is designed with its own advantages and limitations.

### Would you recommend the use of totally enclosed motors if carbon dust or graphite was present in the atmosphere?

In general, yes, because carbon and graphite are a tough combination to lick, since they are both abrasive and conductive. An exception might be a squirrel-cage motor, for then the problem would not be so important, unless there was also a binding agent or oil to make the carbon and graphite stick and clog the air gap. That would probably be a good application for a fan-cooled motor, rather than a totally enclosed one, because maintenance would then be considerably reduced.



**BRUSHES** should be sanded when they are newly installed, or after the commutator or rings have been turned down or ground. This procedure guarantees that brushes will exactly fit the contour of the surface upon which they bear, and resulting contact will be improved.

### In what other ways do motor enclosures affect maintenance?

In general, motors run cooler, have longer bearing lives and carry heavier loads when they are open to the passage of free air. This would indicate the selection of open-type enclosures. Ambient conditions are seldom so ideal, however, that a completely open motor will not require frequent cleaning. Recognizing this fact, some industries have standardized on totally enclosed motors, regardless of applications. This is an extreme policy.

A compromise between these two opposite views recommends the use of "protected" motors, with drip-proof enclosures permitting normal ventilation while protecting windings from falling water, dirt and other foreign substances. The point is that, if maintenance is to be a factor, a motor should be as open as its application, location, accessibility, ambient surroundings and conditions of safety (lack of hazardous atmosphere) permit.

### How long can motor brushes be kept in service?

The purpose of brushes is to maintain good contact on rings or commutators. Therefore, brushes may be used as long as these conditions continue to exist. That is to say, they may be used as long as they are not broken or cracked, as long as spring pressure is sufficient, or

until they have worn down to within a short distance of the ferrule or pigtail insertion.

Brushes should be sanded when they are new, or after the commutator or rings have been turned down or ground, so that they will fit the contour of the surface upon which they bear. Then, at frequent intervals, they should be inspected to see if their condition is still satisfactory.

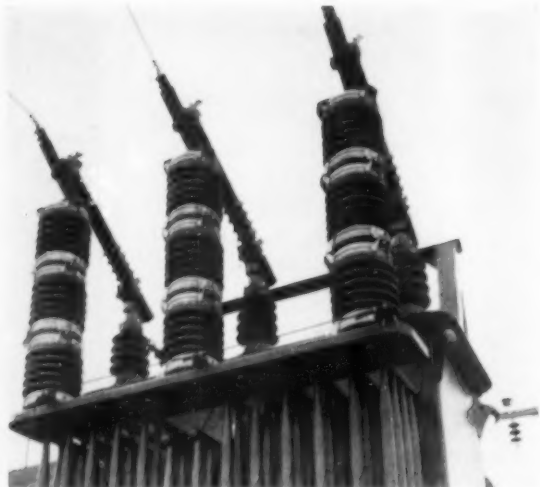
### How frequently should a commutator be ground or stoned?

Grinding or stoning becomes necessary only when poor contact between rings and brushes results. The presence of grooves in a commutator, although annoying, will not give any serious trouble if the grooves are relatively wide and the brush contact is still good. Grooves, however, should be watched, for when ridges between them become high and thin, they may break off and the broken pieces may lodge in the commutator slots. Ridges and grooves are caused generally by grit, by leaving the field on while the machine is at rest, or by improper synchronizing or surge in load. Since one collector ring will frequently wear or get rough faster than the other, swapping the field leads at the rings annually is advisable. Slots should be promptly cleaned whenever oil, carbon or copper particles collect.





**MAINTENANCE** program for load-center substation transformers should include periodic reading of transmission temperature gauges, then resetting of high-point indicators. Comprehensive inspection can be insured by checklists.



**INSULATORS** and bushings of transformers can be cleaned by water under pressure or, in stubborn cases, with solvents and steel wool. Insulators can also be checked for impending breakdown by use of instruments.

## INDUSTRIAL ELECTRICAL MAINTENANCE:

### *Transformers, Switchgear*

**With electrical loads constantly increasing in industrial plants, are there any recommended procedures for obtaining maximum use from transformers?**

There are at least half a dozen ways by which full-capacity utilization of transformers can be promoted. For example, (1) you can check load distribution throughout the plant, balancing those loads by making simple transfers to underloaded feeders, if such exist. This will reduce high neutral currents, reduce overloads on transformer windings and generally improve system conditions. (2) You can also make sure that the flow of air past cooling tubes or radiating surfaces of transformers is unobstructed, adding fans, cleaning coils and ducts where indicated to obtain maximum ventilation. (3) Use of capacitors or voltage regulators will also increase feeder capacity, and (4) voltage regulation can be improved by utilizing primary power at higher voltages and installing load-center unit substations. (5) Take periodic samples of transformer oil and, if

it tests below 22-kv, pass it through a centrifuge or filter press to improve its dielectric strength. Oil which has sludged should also be filtered and tested for acidity. And oil should be kept at the proper level to prevent overheating, poor circulation or overflow. Finally, (6) evidence of leakage should be checked at least once a month, as should all general conditions, including cleanliness and similar housekeeping details.

**What items should be checked when inspecting the exterior of a transformer?**

When checking tanks or cases, look for deterioration of cover gaskets, radiator joints, bushing flanges and conservator connections. Fins of radiators and pipes of cooling coils may also become damaged mechanically. Loose connections can develop from either vibration or temperature changes. Any of these conditions could cause leaks or entrance of moisture.

Tap changers which are operated frequently should also be looked at,

because contacts may wear, bolts and nuts may loosen, or parts may get out of adjustment. This is a good preventive maintenance procedure, because if tap changers fail in service they may require some time to replace. Check primary and secondary voltages periodically with a voltmeter to see that rated voltages are being delivered, and take periodic load tests on the secondary side with an ammeter to prevent equipment overloads.

**What recommendations do you have concerning the maintenance of transformer bushings?**

Since bushings and insulators do not serve their purpose well if they have accumulations of foreign matter upon them, they should be cleaned sufficiently often to prevent the collection of deposits. This interval will naturally vary with location, especially in such places as pulp or chemical mills, foundries or metal-working plants.

Cleaning may be accomplished by water under pressure, or it may require solvents and steel wool.

Instruments are also available for checking insulators by the dielectric power-factor method and, since such tests would reveal impending breakdowns well in advance of their actual failure, the replacement of the insulators could then be safely deferred and scheduled for a planned future shutdown.

#### **How about using a vacuum cleaner to remove dirt from a dry-type transformer?**

This method would be acceptable if the dirt was close to the surface. The normal vacuum cleaner does not develop sufficient suction to remove foreign matter on the inner sections of a dry-type transformer, however, so this method of cleaning might not guarantee a thorough job.

#### **What items should be included on a check-list for high-voltage switchgear?**

Both visual and operational checks are recommended for all high-voltage circuit breakers and, if they are oil-filled, a dielectric test should be included, replacing the oil if it breaks down below the allowable minimum or if there is evidence of sedimentation or discoloration. The mechanical functioning of all moving parts, such as trucks, doors, carriages and lifting mechanisms, should be included also, while all low-voltage wiring and high-voltage parts should be Meggered.

#### **What recommendations do you have for maintaining switches?**

First, be sure that the circuit is locked open at some point ahead of the switch, and that the circuit is dead before the switch is worked on. Then the switch can be cleaned with compressed air, a vacuum cleaner or dry cloth. Screws and nuts should be tightened, especially terminal nuts which may have become loosened due to vibration or alternate heating and cooling cycles.

Contact surfaces of infrequently operated disconnect switches can be cleaned of oxide by opening and closing the switch several times, and pitted copper blades or jaws should be dressed down with a fine flat file. Do not use abrasive cloth or paper on contact surfaces, because non-conductive abrasive particles could conceivably remain on

the contacts. Also make sure that switch blades line up properly with switch jaws, and that proper contact pressure is maintained.

Check tension of spring washers at hinge jaws, making sure that blades move easily without being actually loose.

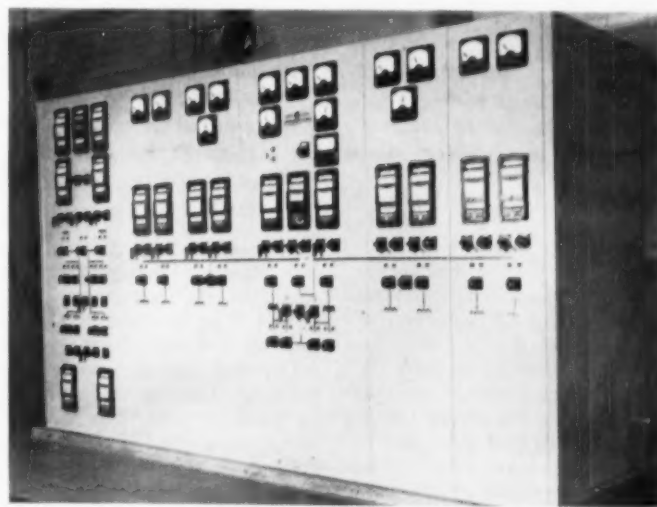
Evidence of switches overheating can generally be determined by discoloration of copper parts, or charring of fuse barrels; check to see that fuse clips and switch jaws have not overheated to the annealing point. Make sure that fuses are of proper capacity, and

that fuse ferrules, blades and link contacts inside renewable fuses are clean.

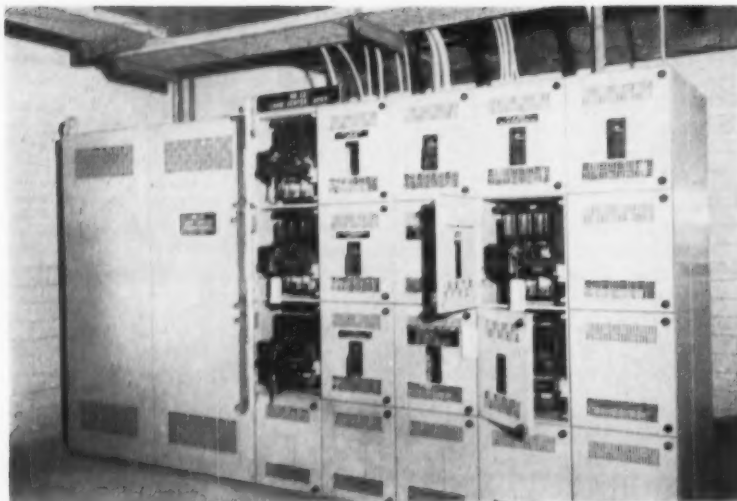
Check operating handles and interlock mechanisms for proper mechanical operation and, finally, all moving parts of a switch should be oiled so as to maintain smooth operation and to minimize wear. Light oil may be used for pivoted connections, but petroleum jelly is recommended for sliding contacts. Excessive oiling should be avoided and, if this condition is noted, it should be removed before completing the maintenance routine.



**DRAW-OUT** breakers which are easily installed or exchanged offer a convenient method for checking, adjusting or replacing worn parts, with complete safety guaranteed to maintenance men performing assignments.



**MIMIC** bus outline on front of switchgear assembly visually relates control equipment to their related circuits, thereby eliminating all guesswork from operation. Status of all switchgear is indicated by colored bullseye lamps.



**EASE** of maintenance is an important factor to consider when specifying and purchasing new electrical equipment. For example, drawout breakers can facilitate and expedite inspection and adjustment, a fact which should be weighed against other pros and cons when deciding upon switchgear.

## INDUSTRIAL ELECTRICAL MAINTENANCE:

# *Specifying and Checking New Electrical Equipment*

**When specifying and purchasing new electrical equipment, what importance should be given to ease of maintenance?**

A lot more than is the general rule. Manufacturers generally spend considerable effort to design and construct electrical apparatus that is easy to keep in good running order, yet many decisions to buy equipment either minimize or completely ignore these plus values. It is understandable that equipment is generally bought on the basis of price, company policy, operating characteristics, prompt availability or a good selling job, yet ease of maintenance should be considered also, and evaluated intelligently, because reduced maintenance can show savings year after year.

For example, the use of nitrogen-sealed power transformers reduces oil sludging. It also increases the periods between necessary oil filtering. Askarel, instead of oil or air as a cooling medium, reduces fire hazards, simplifies installation and minimizes cleaning routines. Draw-

out-type circuit breakers offer a convenient method for checking, adjusting or replacing worn parts.

These facts should not necessarily be decisive points in buying equipment, yet they should definitely be considered as contributory arguments in arriving at a decision.

**When new electrical equipment is received at an industrial plant, what procedures should be followed to check its condition and to insure its proper operation?**

Equipment should first be checked for damage in transit, looking for dirt in working parts, injuries from weather, broken components and the like. It should then be checked against the specification to insure that the list of materials is complete and that dimensions check with drawings. If any defects or deviations are discovered, both the receiving and engineering departments should be promptly notified, so that corrective steps may be taken.

All parts lists, installation information, specifications and drawings should then be filed for future reference.

After the equipment is installed but before its trial operation, all moving parts, couplings, bearings, contacts, etc., should be checked for alignment, freedom of movement and contamination. Wiring, motor and control equipment should also be checked and load tests performed.

Finally, a recommended maintenance check-list should be prepared, being based upon manufacturer's recommendations as well as upon personal experience in the plant, and copies of this schedule should be placed on file in the maintenance department.

**In selecting controls, we are constantly confronted with such alternatives as copper vs silver contact tips, dust-vs water-tight enclosures, roomy vs compact boxes, two- vs three-element overload relays, circuit breakers vs fuses in motor starters, and so on. With so many possible choices, which ones should be rated most important?**

In dealing with proper selection and application of controls from a maintenance standpoint, one can easily become confused by such details as those just mentioned. And they really *are* only details when related to the six basic functions of good control.

Primarily, a control should perform the function for which it was intended. Second, a control should be as simple as proper operation will allow. Third, it should be conveniently placed on the machine or in the motor control center for easy maintenance, operation and protection against dirt or damage. Fourth, it should incorporate readily available replacement parts. Fifth, it should be backed by dependable engineering and a supplier's reputation for prompt service or replacement of defective components. And sixth, a control should be selected for long life with minimum maintenance requirements.

If a control has all of these six requirements, all other considerations will readily fall into their niches of relative importance.

For farm, industrial and special applications:

# Operating 3- $\Phi$ Motors on 1- $\Phi$ Lines

A resume of specifications and operating data on static phase conversion units providing operation of small 3-phase motor loads from single-phase supply lines.

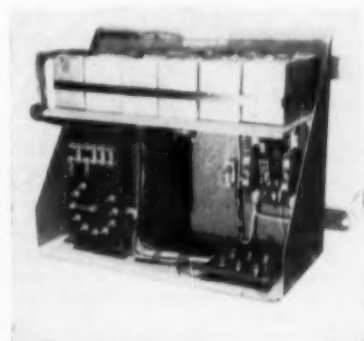
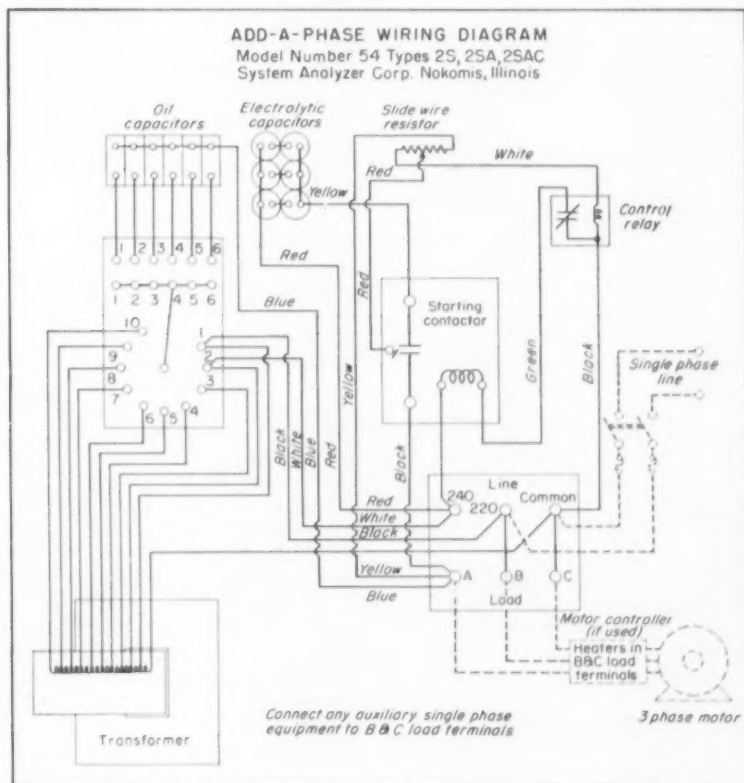
**S**TATIC conversion devices for converting single-phase power to 3-phase power have found widespread application over the past years. Designed to handle relatively small motor loads, these phase conversion units allow operation of 3-phase motors on single-phase lines. Such application offers many advantages on farms, in stores, homes, bakeries, office areas and in many types of commercial and small industrial areas. And in addition to offering

3-phase operating advantages where only single-phase power is available, phase conversion units can be used to provide temporary or emergency 3-phase power in buildings or plants which do have regular 3-phase supply. In such cases, temporary 3-phase power can be supplied to areas not fed by 3-phase lines or to remote or out-of-the-way places by simply connecting a conversion unit to any available single-phase feeder or branch circuit.

## Add-A-Phase

A phase converter known as "Add-A-Phase" is made by System Analyzer Corp., Nokomis, Ill. This unit produces true 3-phase currents, with 120-degree phase displacements, which can be balanced at any load. Constant phase displacements at all loads are essential to prevent excessive currents which might shorten motor life.

Single-phase motors larger than 2 hp are generally objectionable on a lighting service due to light flicker. Such motors draw a very high inrush current at starting, causing severe voltage dips. With the use of a phase converter, a variable-speed or 2-speed, 3-phase squirrel-cage motor can be used on a 240-volt, single-phase lighting service. And low inrush current to the converter tends to prevent light flicker and permits use of larger motors on low capacity lines. The Add-A-Phase unit causes a voltage rise due to one of the circuit elements built into it, offsetting volt-



**CONVERTER UNIT** shown here provides balanced 3-phase currents with 120-degree phase displacements, consists of autotransformer, capacitors, relay and contactor.



age drop due to starting current inrush.

The average single-phase motor will draw a starting current five to eight times the value of running current. With an Add-A-Phase

unit, a 3-phase motor will draw a starting current only about three times the normal running current. And the unit draws a leading current from the line, improving system power factor and increasing

overall capacity of the system.

Add-A-Phase units are built in three models on the basis of torque requirements: 150% torque; 200% torque; and special high torque for air conditioning. Each unit is designed for 220-volt, 3-phase, 60-cycle motors—drawing less than 50% of the current required by a single-phase motor of equivalent size. Units are made for a wide range of motor sizes: 1, 1½, 2, 3, 5, 7½, 10, 15, 20, 25 and 30 hp. The phase converter unit plus a 3-phase motor is about the same price as a single-phase motor in the larger sizes.

### Test I

- A.** Motor under 100% rated load connected directly to utility 3-phase line. Current readings were:

A phase — 23.5 amps.  
B phase — 25 amps.  
C phase — 24.5 amps.

- B.** With same connection, motor operated at 75% full load. Current readings were:

A phase — 19 amps.  
B phase — 16.25 amps.  
C phase — 17.5 amps.

- C.** Still using utility 3-phase current, load was reduced to 62.5%. Current readings were:

A phase — 17.5 amps.  
B phase — 15.25 amps.  
C phase — 16 amps.

### Test II

- A.** Motor connected through Add-A-Phase to utility single phase 230-volt line and operated at 100% rated load. Current readings were:

A phase — 19 amps.  
B phase — 20 amps.  
C phase — 20 amps.

- B.** Add-A-Phase was allowed to remain balanced to give maximum performance at 100% rated load and load was reduced to 75% to determine to what extent phases became unbalanced. Current readings were:

A phase — 20.75 amps.  
B phase — 14.25 amps.  
C phase — 12 amps.

- C.** To determine to what extent phase became unbalanced under increased load without rebalancing Add-A-Phase, load increased to 125%. Current readings were:

A phase — 19 amps.  
B phase — 28 amps.  
C phase — 27.5 amps.

- D.** At this point motor was operated under 62.5% full load, and Add-A-Phase balanced to give what was considered to be satisfactory performance. Current readings were:

A phase — 14.5 amps.  
B phase — 14 amps.  
C phase — 13 amps.

- D1.** Without adjusting the balancing controls on the Add-A-Phase, motor load was increased to 75%. No graph comparison is available for this portion of the test as variation was too slight to be discernable. Current readings were:

A phase — 14 amps.  
B phase — 18 amps.  
C phase — 17.5 amps.

- E.** Still leaving Add-A-Phase balanced to give maximum performance at 62.5% full load, motor load was increased to 100%. Current readings were:

A phase — 14 amps.  
B phase — 27.5 amps.  
C phase — 27 amps.

- F.** Without changing balance of Add-A-Phase, load on motor was decreased to 62.5%, again giving reading as shown in Item D above. Then, to simulate a change in line voltage, the single phase line leading into Add-A-Phase was changed from 240 volt tap to 220 volt tap. Current readings were:

A phase — 17 amps.  
B phase — 15 amps.  
C phase — 11 amps.

- G.** To determine effect if Add-A-Phase balanced at a given point and line voltage dropped and load increased without re-balancing Add-A-Phase, conditions were as described in "F" above insofar as voltage is concerned, with Add-A-Phase allowed to remain balanced for 62.5% load, and load increased to 75%. Current readings were:

A phase — 16.5 amps.  
B phase — 16.5 amps.  
C phase — 15 amps.

**TEST RESULTS** of operation of a 10 hp, 1740 rpm, 3-phase, 60-cycle, 220/440-volt, 24.4/12.2-amp motor on three-phase utility line directly and through an Add-A-Phase converter on single-phase utility line.

### Motor-X

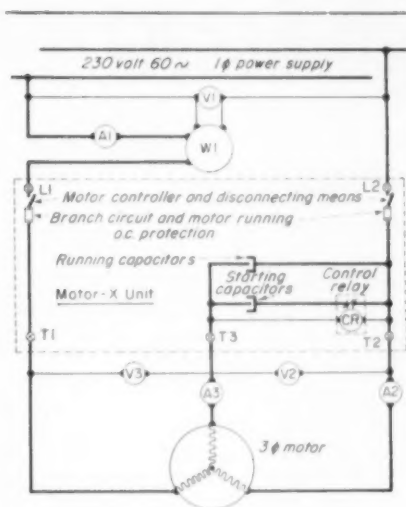
Another unit phase converter is known as "Motor-X" and is available from Phillip E. Graham Company, Inc., Box No. 5538, Indianapolis, Ind. With this unit, both the starting and full-load running power factor are approximately unity. This often permits the use of a larger motor than could otherwise be used, and it minimizes the load on the system.

Motor-X units include branch circuit and motor running over-current protection, a disconnecting means and motor controller. For manual starting no separate switches, fuses or motor starters are required. For remote or automatic starting a conventional magnetic contactor, (or for reversing operation a drum switch or reversing starter) may be installed between the motor and the phase converter.

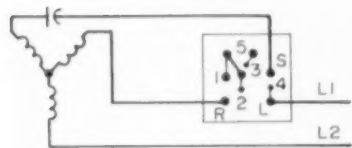
These converters are rated for voltage, frequency, horsepower and class. Each unit is designed for use with a motor of the same rating as the unit. Standard units are designed to operate a 220-volt, 60-cycle, 3-phase squirrel-cage motor from a 230-volt, 60-cycle, single-phase power supply. Class I units are for applications where the actual starting torque does not exceed the rated full-load torque of the motor. Class II units develop starting torques from 125% to 150% of rated full-load torque, depending upon motor horsepower. With either Class I or Class II units, motor breakdown torque is between 150% and 200% of rated full-load torque. Special units for use with other ratings can also be obtained.

Application of Motor-X units is limited to those cases when start-

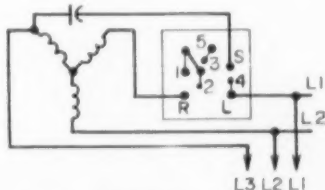
**TABULATION of VOLTMETER, AMMETER and WATTMETER READINGS, and CALCULATED VOLT-AMPERES and POWER FACTOR for 1 HP, 220 VOLT, 60 CYCLE, THREE PHASE SQUIRREL CAGE INDUCTION MOTOR with MOTOR-X UNIT at 242, 233, 215, and 197 SINGLE PHASE LINE VOLTS.**



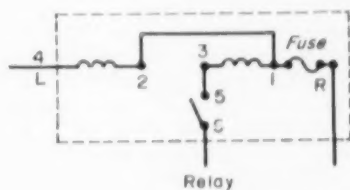
**WIRING DIAGRAM** shows components of Motor-X phase converter and conditions of test made on the unit driving a 3-phase induction motor, with voltmeter, ammeter and wattmeter setups for measuring voltages, power and current for varying conditions of supply voltage and motor torque.



Relay and capacitor connection in one line-conductor for operating a three-phase motor from single-phase supply.



Use of relay and capacitor circuit in conjunction with a three-phase motor at no-load to provide a three-phase supply for starting and running other three-phase motors.



**RELAY CIRCUITS** are shown here for operating 3-phase motors on single-phase lines by using a capacitor and Lewis motor starting relay.

ing requirements do not exceed one 15 second start or 60 one second starts per hour, and starting torque requirements do not exceed about 125% to 150% of rated full load torque. Occasional operation in excess of these limits will not cause failure, but repeated operation of the unit may shorten its life.

In 1, 1½, 2 and 3 hp ratings, the initial cost of a 3-phase motor and a Motor-X unit is slightly higher than the cost of a single-phase motor, disconnect and starter. In

5, 7½ and 10 hp ratings, the cost of a 3-phase motor and Motor-X is usually less than the cost of a single-phase motor, switch and starter.

#### Relay Circuit

Another way in which 3-phase motors may be used on single-phase lines involves the use of a relay. A dual-coil motor-starting relay made by Lewis Electric Co., 1254 W. Harrison St., Chicago, Ill., may be used with a capacitor to

operate star-connected 3-phase motors. For many temporary or permanent installations this represents the most economical way of operating 3-phase motors on single-phase lines.

Operating with the relay circuit, the motor will develop the same high starting torque as a capacitor-start motor, but the running torque and hp output will be reduced about one-third.

A 3-phase motor operating unloaded from a single-phase line in  
(Continued on page 148)

	lb. ft. torque	V1	A1	VA	W1	P.F.	V2	A2	V3	A3
Trans. tap 0-8	NL	242	1.3	315	210	.666	267	3.55	257	3.9
	.76	240	1.7	408	370	.907	260	2.65	257	3.8
	1.52	242	2.45	592	560	.945	253	2.15	256	3.7
	2.28	242	3.1	750	715	.955	237	1.70	255	3.6
	3.05	242	3.95	955	915	.958	235	1.85	253	3.5
Breakdown torque	6.43 (211%)									
Locked rotor torque										
Class I Motor X	4.08 (134%)		17.50							
Class II "	5.38 (176%)		20.50							
Trans. tap 0-7	NL	233	1.0	233	200	.857	260	3.2	252	3.8
	.76	233	1.75	407	380	.922	252	2.4	250	3.7
	1.52	233	2.4	558	550	.985	244	1.75	250	3.6
	2.28	234	3.25	760	720	.948	237	1.5	248	3.5
	3.05	233	4.0	930	920	.99	225	1.8	245	3.3
Breakdown torque	5.83 (191%)									
Locked rotor torque										
Class I Motor X	3.65 (120%)		16.5							
Class II "	5.08 (167%)		19.5							
Trans. tap 0-6	NL	215	1.0	215	170	.790	242	2.6	238	3.55
	.76	218	1.8	393	370	.941	233	1.7	238	3.4
	1.52	217	2.5	542	520	.960	225	1.3	235	3.3
	2.28	215	3.4	730	700	.960	215	1.2	230	3.2
	3.05	215	4.3	925	920	.994	203	1.85	225	2.9
Breakdown torque	5.11 (168%)									
Locked rotor torque										
Class I Motor X	3.36 (110%)		16.5							
Class II "	4.23 (139%)		18.5							
Trans. tap 0-5	NL	196	1.1	216	150	.695	224	2.3	220	3.25
	.76	200	1.9	380	340	.895	215	1.3	220	3.15
	1.52	197	2.65	522	520	.995	203	1.0	215	3.0
	2.28	197	3.55	700	680	.970	190	1.5	210	2.8
	3.05	195	5.0	975	950	.975	175	2.8	205	2.5
Breakdown torque	4.23 (138%)									
Locked rotor torque										
Class I Motor X	3.10 (103%)		14.0							
Class II "	3.5 (115%)		16.5							

Modern engineering calls for . . .

# 480/277 Volts In A High School

Design and installation details on the wiring for power and light in Mount Carmel High School, Houston, Texas. Engineered by Bernard Johnson and Associates, Consulting Engineers, the modern system was installed by Powell and Stephenson, Electrical Contractors.

By D. Dana Price, Chief Engineer,

Goleman and Rolfe, Architects and Engineers, Houston, Texas

**M**ODERN electrical practice—in both engineering design and installation work—is a prominent element in the construction of Mount Carmel High School, Houston, Texas. Here, a skillfully engineered, 480/277-volt distribution system serves large, widespread loads of fluorescent lighting and motors for ventilating, air conditioning, heating and a variety of other operations. A study of the overall system in this school clearly indicates the application advantages of 480/277-volt systems where the proper ratio of power load to lighting load exists.

The high school building is basically a single structure: a U-shaped building—containing two floors of classrooms in each side and a gymnasium, cafeteria, offices and locker rooms in the bottom part of the U—and a small connected building containing the boiler and electrical room and a band room. The layout is shown in the plan view of the school.

Electric service to the building is made at 12 kv, overhead to a pole behind the school then underground to the main unit power center in the boiler room. The underground service consists of four single-conductor No. 4, 15-kv, paper-insulated, lead-covered copper cables in 4-in. fibre duct encased in a concrete envelope. The duct termination at the pole is rigid steel conduit up the pole to potheads. Inside the building, the



**SERVICE POLE** (left) is in 4-wire 12-kv line running behind building. Three hot legs of 12-kv line are carried on insulators on top single-crossarm. Grounded neutral conductor is supported by a clamp on side of pole between bottom and middle crossarms. Details of line taps to service entrance conductors are shown at right. A tap on each hot leg is made from the line on the top crossarm, through a fused disconnect switch on middle crossarm to a pothead on bottom crossarm. Neutral is tapped directly from the conductor to a pothead on bottom crossarm. A lightning arrester is installed on each of three 12-kv hot legs on top crossarm. Four lead-jacketed cables run from potheads into conduit on pole, then underground to power center in boiler room.

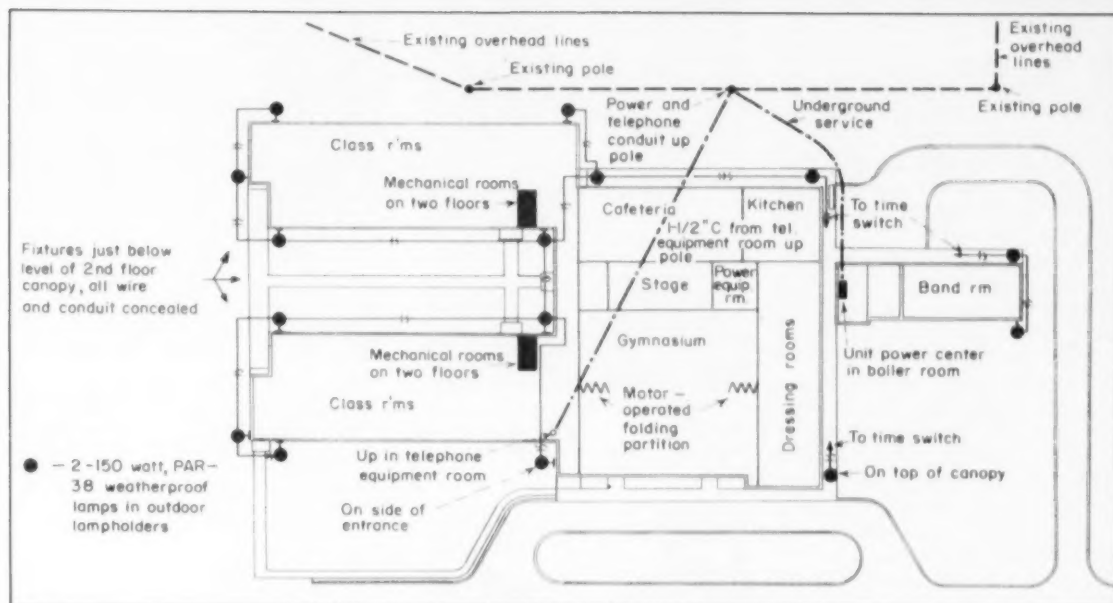
duct terminates in potheads in the power center.

In the boiler room, a dry-type unit power center provides transformation and distribution of the incoming power. Enclosed in a self-supporting metal enclosure, the unit power center is made up of three sections as follows:

1. *Incoming line section:* This is an entrance compartment to ac-

commodate the incoming service feeder conductors, entering at the bottom of the unit power center. Potheads are provided in this compartment, which is an integral part of the transformer.

A 3-pole, gang-operated, two-position, manually operated, air-insulated disconnect switch is mounted in the high-voltage end of the transformer. This switch is



**PLOT PLAN** of school shows layout of interior, arrangement of service to power center in boiler room and hookup of outdoor lighting units which light up building exterior and grounds at night.

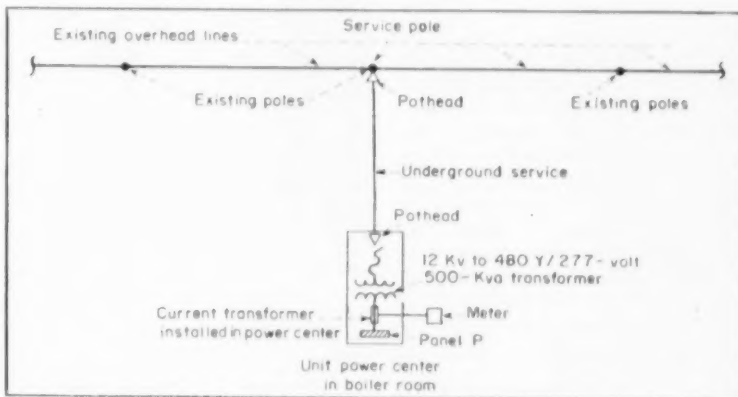
capable of breaking the transformer full-load current. It can carry 400 amps continuously and can withstand a short-circuit current of 2,000 amps for two seconds.

Between the high-voltage disconnect and the transformer, there are three dry-type fuses which will isolate the transformer from the line in the event of internal fault. These fuses have interrupting capacities of 2,000 amps, asymmetrical RMS current.

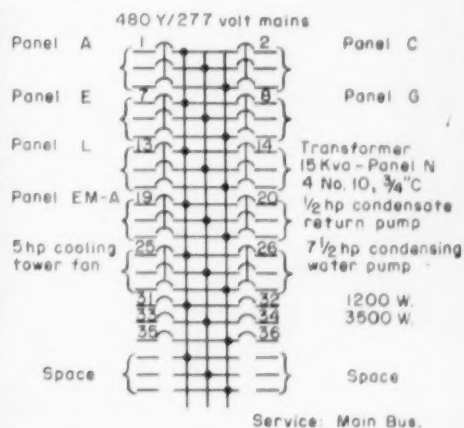
**2. Transformer sections:** The power center transformer is rated 500-kva, 3-phase, 60-cycle, 12,000-volt primary to 480/277-volt secondary. It is a dry-type unit, insulated with Class "B" insulation.

**3. Low-voltage switchgear section:** The low-voltage feeder section is a metal-enclosed, low-voltage switchgear section of the dead-front type, with hinged front doors and removable panels.

From the low-voltage switchgear of the power center, 480/277-volt feeders are carried to power and lighting panels throughout the building. The panels in turn supply motor and lighting loads directly and serve 120/208-volt, 3-phase, 4-wire panels through dry-type stepdown transformers located at various points throughout the building. These transformers are rated 480 volts, 3-phase to 120/208 volts, wye-connected, with four 2½% taps full capacity below normal on primary side. They have very low decibel noise rating and



**UNDERGROUND SERVICE** is run from service pole to main power center.



**POWER CENTER** in boiler room contains 500-kva transformer and 480/277-volt secondary CB distribution panelboard in end of enclosure. At right is main distribution panel circuiting, showing feeders to other 480/277-volt panels, feeders to motors for air conditioning equipment and a feeder to a 15-kva transformer supply.



are mounted on isolation pads loaded to 30 to 40 lbs per sq ft.

In addition to the modern distribution method, the school electrical system includes a wide range of modern lighting techniques on both 277-volt and 120-volt circuits. Lay-out and circuiting of lighting are shown in illustrations.

An important consideration in designing a 480/277-volt system is apportioning lighting and miscellaneous loads between 277-volt panels and 120-volt panels. A look at the accompanying panel schedules shows maximum use of 480/277-volt devices to minimize requirements for step-down transformers. For low-wattage lighting needs, standard incandescent units were used. In the gymnasium, incandescent lighting is used throughout, on 120-volt circuits, to eliminate any stroboscopic effect.

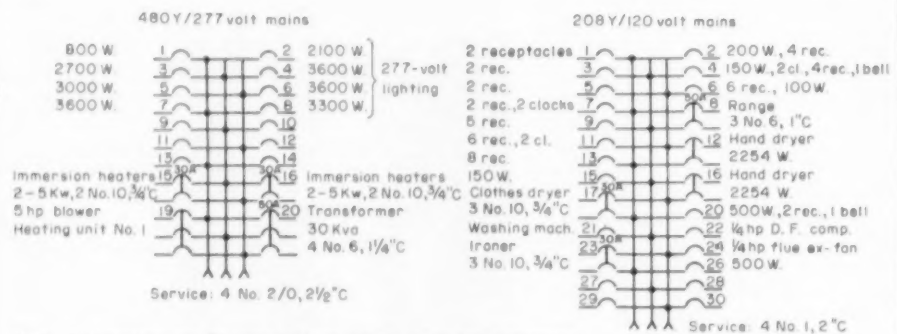
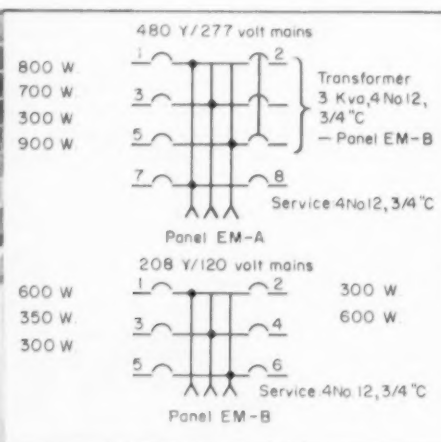
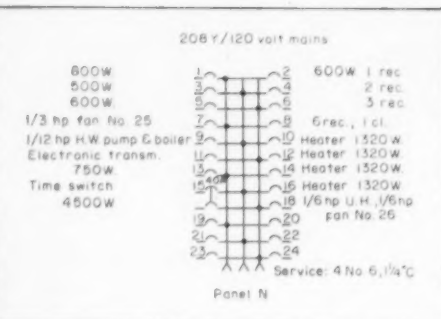
Another important characteristic of the electrical system here is the substantial amount of spare capacity engineered into feeders, panels and circuits. Such extra capacity minimizes voltage drop and copper loss, assuring efficient operation of equipment, in addition to providing flexibility for future load growth and/or expansion of the overall system. And load balance on different phases in feeders and panels was made with careful consideration of diversity of single-phase electrical utilization, minimizing the possibility of heavy load on one phase while another phase is relatively unloaded.



**LIGHTING PANEL** alongside power center in boiler room is supplied from 15-kva transformer which steps 480/277 volts to 208Y/120 volts. Transformer is fed by three No. 10's in 3/4 in. conduit (coming down at left in photo) from circuit in power center distribution panel.



**EMERGENCY PANELS** in boiler room are supplied from power center panel by four No. 12's to 480/277-volt panel (at left in photo). Emergency 277-volt lighting circuits are supplied from this panel. Other emergency lighting loads are fed from 208Y/120-volt panel (at right in photo) supplied from 480-volt panel through 3-kva transformer shown.



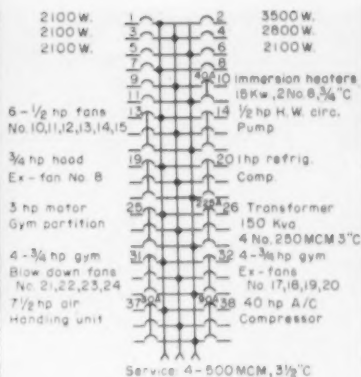
Note: All breakers are 20-amp on both panels unless noted otherwise.

**TYPICAL LAYOUT** of transformer and panelboards, in one of four mechanical rooms serving classroom wings of building, includes 480-volt panel (left rear in photo) fed up through slab by conduit feeder from power center. (Conduit feeder to similar layout in mechanical room on floor above can also be seen behind panel in rear of photo). Classroom and corridor lighting for each floor of each wing is supplied by 277-volt circuits from 480/277-volt panel in mechanical room. Other loads, as shown in panel diagrams at right are supplied at 208Y/120 volts, through 30-kva transformer. Contactors for water heaters are shown on wall at extreme right (in photo). Mechanical rooms are sound-proofed by Fiberglas batts on walls. In panel schedules, note variation in number of receptacle outlets connected to individual circuits. Layout and circuiting of receptacles were based on study of likely loads, possible simultaneous use of appliances and habits of use of electrical appliances. In home economics classroom, for example, heavy appliance loads and sewing machine desks dictated use of only two receptacles per No. 12, two-wire circuit. Other circuits have five, six and eight receptacles.

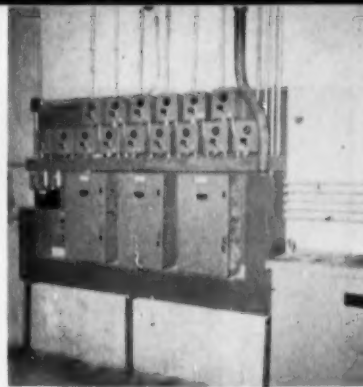


**150-KVA TRANSFORMER** and power panel are installed in large, sound-conditioned, power equipment room adjacent to gymnasium. Panel is fed up through slab by four 500 MCM conductors in 3½-in. conduit run from power center. Circuits and loads for Panel L are shown at right.

480Y/277 volt mains



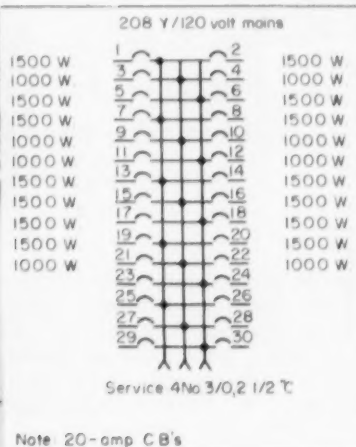
Note: CB's 20-amp, unless noted otherwise



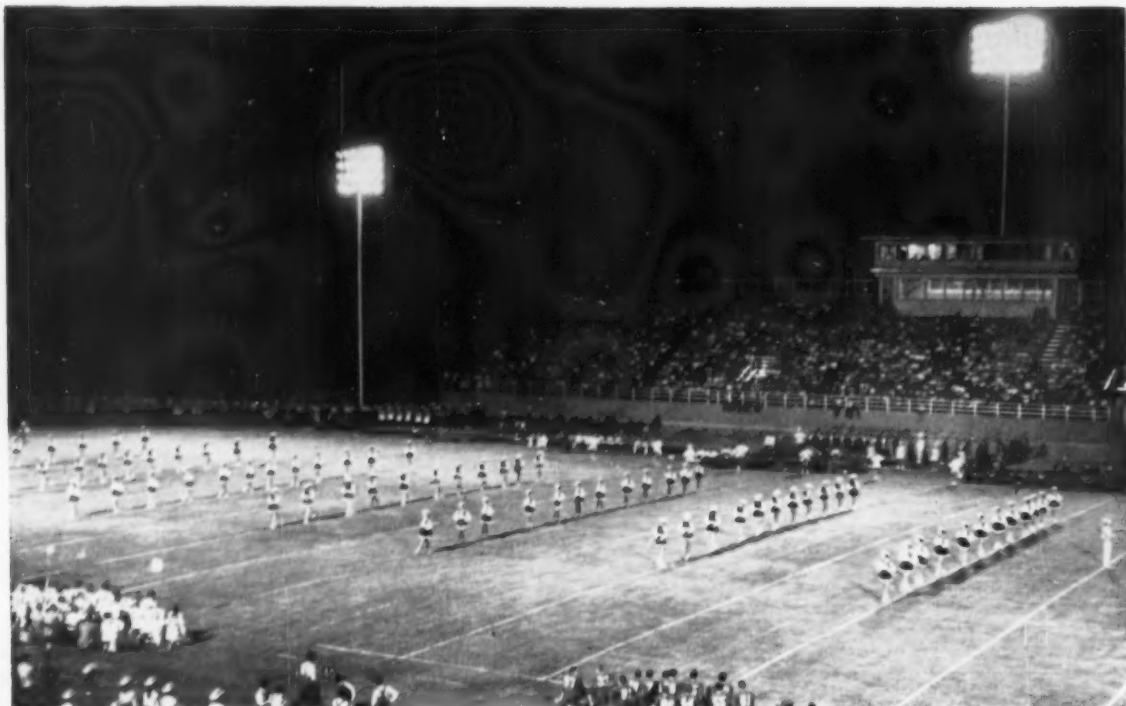
**FUSED SWITCHES** (three in middle of photo) are 200-amp fused disconnects for each of three sets of four No. 3/0 feeder conductors to remote 208Y/120-volt panelboards. Three sets of feeders are tapped from secondary conductors of 150-kva transformer (right). Starters for fans are racked above wireway.



**CAFETERIA** (with tables folded into vertical positions) is lighted to 40 footcandles by 21 surface-mounted, shallow, 4-ft by 4-ft, plastic-shielded luminaires, each using six 40-watt, standard cool white, rapid-start fluorescent lamps. Luminaires are balanced on a 20-amp, 3-phase, 4-wire, 277-volt-to-neutral circuit—seven units between each phase and neutral of circuit run from 480/277-volt panel in power equipment room. Units are 14 ft apart from front to back in photo; three rows are 15 ft apart.



**GYMNASIUM** is lighted by 58 incandescent RLM dome luminaires, each suspended on a 2-ft, 6-in. pendant with swivel aligner and equipped with a 500-watt inside-frosted incandescent lamp shielded by concentric louvers on the unit. Units are circuited at 120 volts from panelboard on stage at end of gym. Note conservative loading of circuits.



***Engineering design is the basis for . . .***

## **LIGHTING TWO ATHLETIC FIELDS**

**Butcher Electric Service, electrical contractors, Dallas, Texas, installed two sports lighting systems planned by Fred Buford and Associates, Architects and Engineers, Dallas, to provide high-level, comfortable light for night football and baseball.**

**T**HE usual construction pattern for high school athletic facilities, especially if they are to be floodlighted, is to build the school then the playing field, or at least to develop and complete both school and playing field concurrently.

But the Dallas, Texas, Board of Education has made an exception to this pattern. It has just completed Sprague Field—consisting

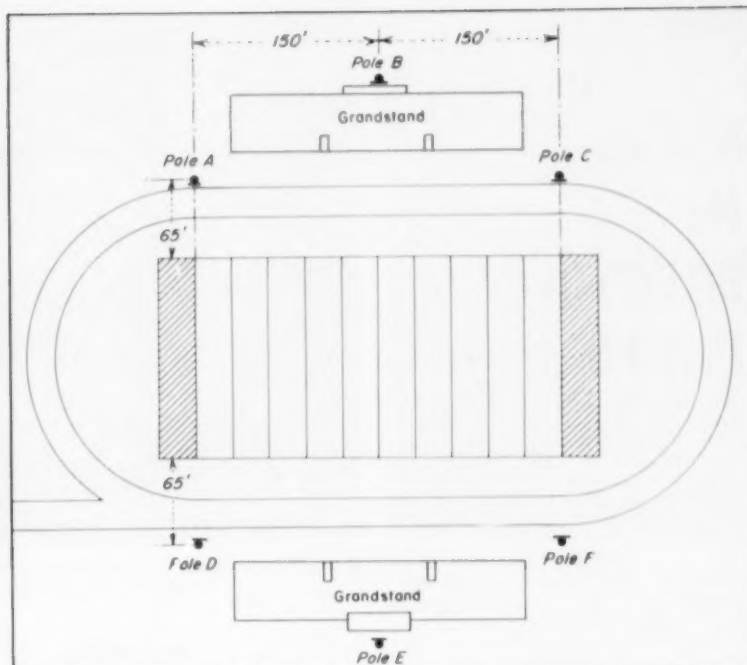
of two separately floodlighted athletic fields—on a tract of land that also will be used as the site of a \$2½-million high school. Construction of the school, to be called Justin Kimball High School, is currently underway. The floodlighting for the two fields, one for football and field events and the other for baseball, has been in use since last September.

Both stadium bleachers (seating capacity 6,000) and the baseball grandstand (total seating capacity 1,500) are roofless stands constructed of light structural steel supported on concrete footings. A parking lot borders the stadium's west side, and will be floodlighted upon completion of the Justin Kimball High School.

The complete floodlighting sys-



**FIRST STEP**, after pole was placed at ground position where it will be erected, was assembly of catwalks and crossarms on top of pole. Simultaneously, wiring was run through length of pole.



**POLE LAYOUT** for football field.



**FLOODLIGHT UNITS** were attached to steel crossarms on poles. Unit is cast aluminum, with a tempered glass cover protecting bulb and reflector from weather and insects. Head of the unit can be swung back and latched in open position for relamping and cleaning, without altering original position of unit.



**FLOODLIGHT PRE-AIMING** was done on ground by adjusting each unit for given settings of horizontal and vertical degree markings on the unit in accordance with an aiming chart, supplied by Crouse-Hinds, to provide various angles for units. Aiming, in this way, depends upon accurate installation of crossarms in level positions.

tem totals 320 floodlights, distributed among 14 Tulito welded steel poles which vary in height from 60 to 100 ft. The floodlights are Crouse-Hinds FLA sportlights, using 1500-watt, PS-52 bulbs, and operated at 10% above rated voltage to obtain a 35% increase in light output.

Football fields are illuminated primarily to suit the comfort of

onlookers in the stands. Since a football is readily visible to players, they require a relatively low level of lighting. This need is filled by spotting enough light on the field to enable spectators in any part of the bleachers to follow the plays. The rule is: if a fan can easily see the football, then the players have enough light to enable them to play as competently at

night as they would in daylight. Actually, the real problem is to provide adequate lighting on the playing field and still prevent excessive glare. One sure answer is mounting the floodlights at proper heights.

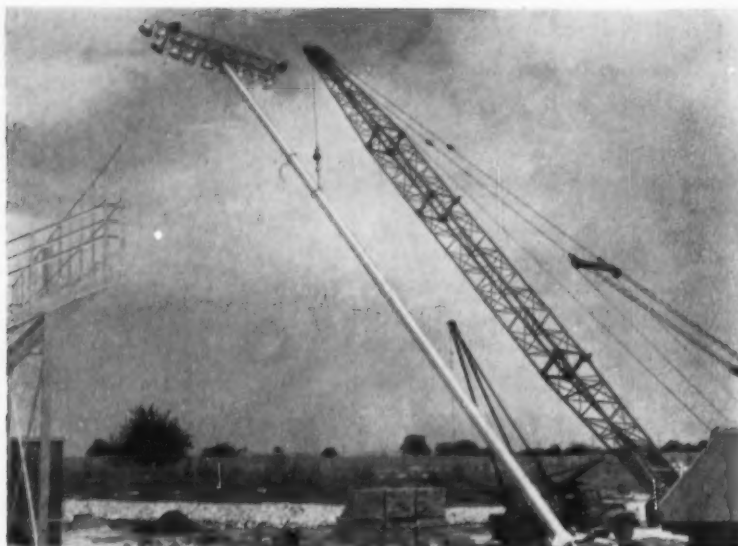
Based on its dimensions (360 ft by 160 ft; seating capacity, 6,000) Sprague Field's gridiron falls into the Class II category for football



# STEPS IN ERECTING POLES

sports lighting as recommended by the IES. These categories are:

Class	Distance—Nearest Sideline to Farthest Row of Spectators
I	over 100 ft
II	50-100 ft
III	30-50 ft
IV	under 30 ft
V	no fixed seating
Class	Seating Capacity
I	over 30,000
II	10,000-30,000



1. **POWER CRANE** is used to hoist fully assembled pole onto four anchor bolts imbedded in concrete footing.

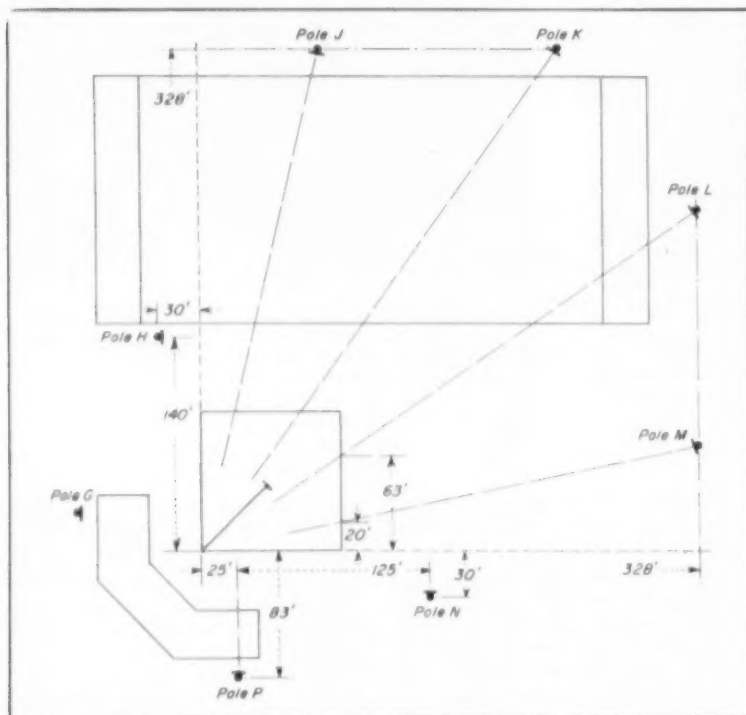
III 5,000-10,000  
IV 5,000  
This classification is based on the distance between the sidelines and the farthest row of spectators, which at Sprague Field is 135 ft, and the size and capacity of the bleachers. The latter factor elimi-

nated any problems presented by the former. Because the bleachers extend only part way down the length of the field, the need to place all of the poles at a distance of 135 ft from the sidelines was unnecessary. If the seating capacity were much larger, all narrow beam floodlights would have been required, mounted on 100-ft poles.

Consequently, only two 100-ft poles, B and E, each supporting 32 narrow-beam luminaires, are located behind the centers of the bleachers. Four 70-ft poles, A, C, D, and F, with 24 wide-beam units per pole, were spotted 65 ft from the sidelines at each corner of the field. This combination—wide beam floodlights for the shorter distances between the poles and the sidelines, and narrow beam units for the longer spans between the field's edges and the backs of the bleachers—produced an average footcandle reading of slightly better than 45 ft-c over the entire playing area, a lighting level suitable for playing football.

## The Baseball Diamond

Outer limits of the Sprague Field ball diamond measure 328 ft to a side, forming a square that is roughly equivalent to most semi-pro baseball fields. For nine players to see and handle a small baseball that at any moment either can carom down the infield or be driven



**POLE LAYOUT** for baseball diamond.



**2. ANCHOR BOLTS** are tightened down to secure pole mounting, and wiring from floodlights is spliced to feeder fed up through footing conduit.



**3. POLE-TOP ASSEMBLY** has fifteen-foot crossarms supporting six (eight in other cases) floodlights per tier. Each pole has two catwalks and a set of steps.

upward towards the far reaches of the outfield, maximum illumination is required over all the diamond. Likewise, lighting intensity must be high enough to enable fans anywhere in the stand to follow the actions of the players. Finally, a strip 30 ft in width around the outside of the base paths and along the foul lines must be included as part of the total playing area when reckoning its floodlighting requirements.

To meet these conditions, 160 floodlights were mounted on eight steel poles (see sketch). The poles hold the luminaires at heights that focus light not only over both the infield and outfield but *through* the air over the field. In this way light beams from the floodlights illuminated the upper surfaces of a baseball while reflected light from the field brightens the ball's bottom surfaces. The net effect is to spotlight the ball no matter where it is moving—in the air or across the field.

Because the distances between the pole-mounted floodlights and the baseball field are much shorter than those on the football field, there was little need for narrow beam luminaires. In some instances however, different reflectors were used to throw more light on the active areas of the infield. Covering the infield are poles G, H, N and P—all 70 ft high. Fifty-degree reflectors are used on each of

the 16 floodlights making up the floodlight clusters of poles G and P, which illuminate the bleachers, home plate and pitchers' mound. Poles H and N, each with floodlight clusters fitted with 80-degree reflectors, brighten the hard-worked first and third base areas. Poles J, M, K, and L, all 60-ft in height, hold 16 floodlights each. Poles J and M have 12 80-degree and four 50-degree units per pole; poles K and L each have ten 80-degree and six 50-degree floodlights. The slightly narrower patterns of the 50-degree luminaires direct enough light to the area just beyond the infield to maintain constant uniformity of illumination over the entire field. Footcandle readings, taken during final tests of the floodlights, average 20 ft-c in the infield, 15 ft-c in the outfield.

#### Distribution Features

Independent of the service for the proposed high school, and separately metered, Sprague Field's electrical service is derived from a 2400-volt, 3-phase, 3-wire, utility overhead transformer rack located on the stadium's east side.

Three substations are used and are equipped with primary fused disconnecting devices, step-down transformers and secondary distribution panels. The football field transformers are indoors, and have

225 kva capacity. The outdoor baseball field transformer is 300 kva. Primary voltage for the three transformers is 2400 volts, 3-phase, 3-wire, 60-cycle, delta with two 2½% full capacity taps above, and two 2½% full capacity taps below rated voltage. Low voltage rating is 120/208 volts, 3-phase, 4-wire, wye with the neutral brought out. Feeder panelboards are located under the three field bleachers.

Lighting panelboards are attached just below the catwalks of each pole, and are bussed for the low voltage feed. Panelboard circuit breakers are wired with sequence phasing.

After the floodlights were assembled and mounted in tiers of either six or eight units to a cross-arm, a power crane hoisted each pole into position. All but four of the poles were anchored to wedge-shaped concrete footings 7 ft deep. Poles A and H, both 70 ft high, were set on T-shaped footings 10 ft, 4 in. and 5 ft deep respectively. The footing of pole B contains feeder conduit from the stadium west side bleacher. Conduit from the ball diamond substation is similarly fed into pole P. For each of these poles, feeder conduit is run down through the cement base of the floodlight pole and comes out on the underside of a concrete cap, which is made flush with and parallel to the finished grade surrounding the pole base.



**NEW BRIDGE** over San Francisco Bay is the Richmond-San Rafael bridge, double deck type, 4 miles long with 1.5 miles of approaches.

# Fluorescents Light New Bridge

New \$68-million 4-mile bridge across San Francisco Bay uses 422 4-lamp fluorescent luminaires to light roadway and approaches. Lighting and electrical work was done by three electrical contracting firms, for sum of \$1,757,694.50, or 2.9% of total project cost.

**F**LUORESCENT luminaires were used exclusively to light the world's longest high level bridge, a four-mile double-deck span connecting California's Marin County on the West side of San Francisco Bay with Contra Costa County on the East side. A total of 422 units were required: 332 units on the two decks of the bridge, 32 units on the toll plaza, and 58 units on the 1.5 miles of approaches. The bridge is known as the Richmond-San Rafael bridge, since it connects these two California towns.

This new bridge was opened to traffic on September 1, 1956, and is scheduled for full completion by the early fall of 1957. Its total cost will be about \$68 million. It has two 3-lane decks, the upper for westbound traffic and the lower for eastbound traffic. It replaces the old Richmond-San Rafael Ferry which has been in operation since

By Berlon C. Cooper

1917 handling traffic across the Bay and between the two counties. This ferry system transported 1,100,000 vehicles in its last year of operation. It is expected that the new bridge will handle 3,912,000 vehicles during its first full year of operation, and the project engineers estimate that by 1980 the bridge will be handling about 8,200,000 vehicles annually.

The over-water crossing of the bridge is 4.0 miles long, but the total length of the project, including approaches, is 5.5 miles. The over-water part terminates at the eastern (Richmond) end on an earth fill upon which are located the toll plaza and toll collecting facilities, as well as administration and maintenance buildings. The bridge, as well as the approaches,

is built on freeway standards and provides the only route in the area with grades of 3% or less, which is conducive to truck traffic.

Fluorescent streetlighting equipment was selected for lighting this bridge only after long and careful study of the many seeing problems involved, and after full consideration and testing of equipment using all four light sources—incandescent, mercury vapor, sodium, and fluorescent. Selection of the fluorescent was on the basis that it provided the most luminous efficiency combined with a minimum glare effect, a minimum of color distortion, and the longest average life. Luminaires are General Electric Co. Form 406 multi-lamp units. The multi-lamp feature will insure that each unit remains lighted when an individual lamp burns out.

In studying the specific seeing problems involved in the lighting of this bridge, it was recognized

that reduced visibility is a primary cause of the high rate of night accidents as compared with the day rate. Thus special consideration was given to the lighting design to provide maximum visibility and safety at night.

The vehicular speed assumed for the bridge and approaches, for purposes of lighting system design, was 60 mph. Also, the two stages of construction planned for the bridge, in which each the upper and lower decks would be used for a period of approximately six months each for two-way traffic, were considered. In addition, based on experiences at the University of California's streetlighting laboratory, the following were considered as main factors in the lighting system design:

1. Background at night is dark.
2. Reflectance of concrete deck surface is relatively high when dry, and low when wet. Reflections of the surfacing on the approaches compared with the deck concrete is low when dry and even lower when wet.
3. No shoulders are provided on the bridge for emergency parking.
4. Traffic will consist of passenger cars and trucks.
5. Mounting height and structural mounting of luminaires are determined by the bridge design.
6. Silhouette discernment and recognition of surface detail have to be adequate for good visibility.

To meet these conditions, a lighting system was designed which would provide good peripheral vision over the entire 3-lane width, with comfortable seeing conditions and relatively even pavement brightness under both dry and wet conditions. This system prevented either direct or indirect blinding glare, or effects which would interfere with driver vision.

Several luminaire mounting arrangements were studied, with the result that the overhead position, with the unit transverse to the roadway, was selected.

On the upper deck, luminaires are mounted on poles and brackets in a staggered pattern. Pole spacing varies from 138 to 150 ft, and unit mounting heights vary from 27 to 29 ft. Luminaire brackets used on the cantilever section of the upper deck are spaced from 85 to 103 ft and mounting height varies from 18 to 20 ft.

On the main section of the lower deck, the luminaires are mounted



**ILLUMINATION** is provided by 422 4-lamp General Electric Form 406 fluorescent luminaires. Intensity on upper deck (shown here) is one footcandle average, on lower deck, 1.5 footcandles average.



**TOLL PLAZA** is brightly lit by fluorescent luminaires to speed traffic through toll area safely.



**DOUBLE DECK** arrangement is shown in daylight view of bridge terminal with land on Richmond side of Bay.





**GRADES** on new bridge are less than 3%, and lighting outlines structure across entire Bay in clear weather.

transversely, over the center of the roadway, on brackets fastened to the upper deck girders. The bracket spacing varies from 110 to 130 ft with mounting heights varying from 22 to 24 ft.

While testing proposed luminaires on the completed portion of the bridge during the winter of 1954, it was found that upward tilting of the fluorescent luminaires mounted on the side of the roadway considerably improved their lighting pattern.

Mounting brackets were subsequently supplied by the luminaire manufacturer which permit units to be installed in three positions:

- (1) horizontal position—for the lower deck and cantilever section of upper deck;
- (2) 15 degrees above horizontal—for the truss and plate girder spans of upper deck, toll plaza and approach roadways;
- (3) 25 degrees above horizontal—for possible future needs.

Each luminaire contains four 800 milliampere, 72-in., T-12 rapid-start, standard warm white, GE fluorescent lamps. Two Alzak aluminum parabolic reflectors provide an IES Type I wide distribution pattern.

A Plexiglas cover fastened securely to the aluminum hood contributes to the diffusion qualities of the available light and protects the inside of the unit from corrosion, dust, and rain.

The photometric tests showed an illumination pattern with a maximum to minimum ratio of 5:1 and a brightness pattern with a maximum to minimum ratio of 4:1 for a spacing of 138 ft and a mounting height of 27.4 ft. The total average illumination on the upper deck will be 1.0 footcandle maintained, while on the lower deck an average of 1.5 footcandles will be maintained.

Mechanical tests showed that luminaire displacements due to winds up to 40 mph were not appreciable and that the stresses in the steel poles were conforming to calculated values. No tendency toward aerodynamic instability was exhibited.

### Power Distribution

In order to assure a maximum of dependability of roadway lighting and other electrical equipment, two 750 kva transformers were installed, one at the Richmond (east end) substation and the other at the San Quentin (west end) substation. These transformers receive power directly from the electric utility company at 12 kv and are so interconnected that a power outage at one side of the Bay will cause the other transformer to assume the entire load until the power outage has been corrected. This switchover is automatically performed at one of the two additional substations located respectively inside the pier structure of the main cantilever tower at the west and east cantilever sections.

Power-factor corrected 30-kw constant-current transformers located at all four substations feed the different series lighting circuits. From 24 to 27 luminaires are on one 6.6-amp circuit. Two types of circuits are used: 1) the standard closed secondary loop used for the toll plaza area and the approaches and, 2) the grounded return type used for feeding the luminaires located on the bridge structure.

Each circuit through a 1-conductor No. 6 bronze armored cable feeds external insulating transformers or ballasts. These are required to provide the necessary starting voltage and to limit the current for each luminaire. On the bridge structure these transformers are bolted to the steel members near the base of the pole or bracket, and on the approaches the transformers are located in

concrete boxes buried near the base of the pole.

Each group of two lamps connected in series, one on each side of the luminaire, is controlled by this transformer. Should one lamp fail two lamps will remain lighted. In addition to the insulating transformer a filament transformer within every luminaire assures preheating of the electrodes. With the 800-milliampere lamps, optimum operating characteristics will be obtained with the usual ambient temperature of the Bay area. An average lamp life of over 10,000 hours is expected for 10 hours per start.

Photoelectric cells mounted at all substations automatically operate the luminaires. Should a failure of the cells occur it will immediately be corrected by the Toll Sergeant in the Administration Building, Richmond, who will turn the defective circuits on or off, through manual control, from the supervisory control board. At all times this board gives an indication regarding the functioning of every lighting circuit on the entire project, and shows the operation of the navigation lights, the foghorns, and the four aviation beacons which are installed over the east and west navigation channels.

The entire Richmond-San Rafael Bridge project was designed, and its construction supervised, by the California Department of Public Works, Division of San Francisco Bay Toll Crossing. N. C. Raab, Projects Engineer and Chief of the Division, directed the project. Electrical facilities design was under the direction of H. B. Thysell, while toll collection and communication facilities were handled by J. I. Burt. Lighting engineer for the entire project was R. B. Marxheimer.

Electrical work, including lighting equipment, was let in three separate contracts. The electrical and mechanical work for the upper deck and toll plaza area was performed by Newbery Electric Corp., on a bid of \$1,020,711. L. H. Leonardi Electrical Construction Corp. did the lighting of the lower deck and approaches, for a bid price of \$254,436.50. The toll collection equipment contract was awarded to Scott-Buttner Electric Co. for \$482,547. Total cost for all electrical work, including the lighting equipment, was \$1,757,694.50, or approximately \$320,000 per mile.



**ELECTRICAL CONSTRUCTION  
AND MAINTENANCE**

**ELECTRICAL WHOLESALING**

## **PRACTICAL IDEAS FOR National Electrical Week**



The second annual Week is a good time to tell the public the story of the electrical industry—and its value to your community.

**F**EBRUARY 10-16 will see the second annual celebration, on an industry-wide basis, of National Electrical Week. It is expected to have considerably greater impact than in 1956, with stronger activities nationally and locally.

The Week, an outgrowth of a program sponsored by the International Association of Electrical Inspectors, is now sponsored by 12 leading industry trade associations and groups. It also is endorsed by a number of groups outside the trade field.

The Week is conceived as an "event" rather than a "promotion." It gives electrical companies and groups the opportunity to tell the industry's story to the American people—from Edison's lamp to the generation of electricity by atomic power and beyond—in terms of better living for all through cheap power.

There's also a commercial aspect, in muted tones, to NEW. Industry public relations can be furthered by putting the spotlight on what individual companies are doing, and on what products and services the industry brings to the nation.

And finally, the Week has a value in terms of the industry's programs for electrical living. Such programs as Live Better Electrically and Housepower are going concerns. They talk one basic idea: the consumer's welfare. NEW is adapted to playing up these programs, calling public attention to the

added convenience and safety of up-to-date electrical service for the home.

For you, NEW means an opportunity—to tell a strong, solid industry story and to tell your own story at the same time. Many national and manufacturer plans for NEW are already set. For the individual contractor and wholesaler, this is the time to add a hefty local voice to the industry's publicity barrage on its own behalf.

**THIS 16-PAGE SECTION**, prepared by the editors of **ELECTRICAL CONSTRUCTION & MAINTENANCE** and **ELECTRICAL WHOLESALING**, is designed to help you make the most of this giant industry-wide activity in your home locality.

This editorial feature includes:

- **14 Ways You Can Promote NEW Locally**—practical ideas which your company and your league or industry group can use. There's also a listing of materials available for local use.

- **Three worksheets** for the appraisal and sale of wiring systems for (1) residential, (2) commercial and (3) industrial customers. These working tools include a checklist for planning electrical modernization and detailed suggestions on what problems must be considered.

# 14 Ways You Can Promote NEW

## By Group Action:

It is in local activities that National Electrical Week can best be utilized to tell the industry story. And organization of distributors, contractors, dealers, inspectors, utilities and other industry segments is the first step in getting ready to tell this story.

Your league can take the initiative in forming a local NEW committee. Or perhaps this responsibility can be assumed by a chapter of NECA, IAEL or NARDA.

Otherwise, one man or one company—taking the lead—can organize a committee. Whatever the method of organization, all possible industry groups should be represented. So should non-industry civic groups, such as the chamber of commerce; even if they are not formally represented, you can work closely with these groups.

Once there's an organization and an agreement on local Week goals, a program should be set up that fits your local situation: the money and time available, and the extent of cooperation likely from newspapers, civic groups, schools, etc.

Here, in brief, are some ideas that you may be able to use:

### 1. Proclamation by the mayor

This is a sure way to publicize NEW and start things moving. A proclamation by the mayor is a natural news-maker.

The text of the mayor's statement should be submitted in advance for approval. It should include



pertinent information about NEW and appropriate remarks about the local electrical industry. Arrangements should be made for a press release and for photographs. (For pattern news release, plus other NEW promotional materials, see list at right.)

If your town is a metropolitan center, there's an opportunity to include suburban mayors—and suburban newspaper publicity. And, with the help of your trade associations, the Week might be proclaimed by the governor.

### 2. Speeches to civic groups

Local groups—service clubs, professional and civic groups, PTAs, social clubs, etc.—are interested in

non-commercial speeches on general topics. Chances are that these groups would be responsive to a suggested speech on NEW.

These organizations may be reached through the speakers bureau of your league or utility. Or you may want to set up a bureau for NEW. Its responsibilities would include determining what speakers are available, contacting organizations and making speech arrangements, scheduling who talks where, and deciding speech topics.

Speech topics generally should be broad so the speaker can refer in passing to a range of items: industry tradition and development, industry outlook, specific value of the industry to the community.

Also available are films for showing at such meetings—and possibly at motion picture theaters and on television. (See list.)

### 3. Talks to school assemblies

High school children and their teachers welcome similar talks. They can be presented together with a student project such as IAEL's home electrical inspection reports.

"Electricity in Your Home," a folder designed for easy checking of the adequacy and safety of home wiring systems, has been used successfully by inspector groups. (See list.) This folder, for use in a community-interest project by students, might be passed out at the end of a school assembly talk on NEW.

### 4. Planning of civic meetings

A civic luncheon or dinner, with an outstanding industry speaker, set the stage for effective NEW publicity. Such an affair might be set for Feb. 11 and billed as Edison Day. It could be arranged in co-sponsorship with a community organization.

The Week also provides an opportunity to bring together people from various segments of the industry—perhaps in connection with celebration planning or at a Week function.

### 5. Special displays or exhibits

NEW displays—perhaps tracing the development or future of the industry in terms of its meaning to the average citizen—can be arranged with local organizations.

Lobby or window displays in banks are effective, and are often encouraged by bank officials. Other locations that might be utilized include schools, libraries, department stores and small retail outlets—appliance dealers first of all. Suggested themes are models of atomic power plants, and electrical progress dramatized by contrasting old and new appliances.

## — Locally

### 6. Special newspaper sections

Your group might suggest that the local newspaper feature, possibly in its Sunday edition, a section tying in with NEW.

This is an opportunity to present editorial material on the industry, particularly that with a local slant—contributions in terms of wiring and appliances for better living, of lighting for better retail shopping, of power for mass industrial production, and the like.

In connection with such a newspaper section, local concerns—both in and out of the industry—can be urged to advertise. Such advertising may be general (i.e., on the industry, institutional (on service of a company to the community) or sales-oriented (on a new model electric home or appliances).

### 7. Use general advertising

National Electrical Week is a likely time for saturation local advertising: from newspaper ads to direct mail pieces to TV and radio commercials.

There are also non-commercial opportunities for your group. Perhaps a local quiz show would be



receptive to including a series of questions about electricity and the industry during a show broadcast that week. Or an interview show might invite a representative from the industry to discuss an NEW topic.

### As An Individual Firm:

National Electrical Week provides a neat opening for promotion of your company, its products and its services to the community. Your firm can use this event to (1) associate your company name with the industry and with the Week, (2) spell out what services you offer, and (3) tell the community what you are doing right now.

Like the group activities for NEW, such promotion requires planning and coordination. It involves your sales and advertising activities, and the activities of your field men.

### 8. Tell the story to employees

It may seem trite, but NEW is a good time to remind your employees what their industry stands

## What's Available For Local Promotion

Here's a partial listing of the materials available to you for promoting National Electrical Week at the community level:

### From the NEW Committee:

- Planning guide. List of suggested plans and projects, in detail.
  - Emblem. Reproduction proofs, for use in advertising, exhibits, etc.
  - Basic 20-minute speech. Covers electrical progress, the industry's contributions to the nation and the significance of the Week.
  - 20-minute talk on adequate wiring.
  - Publicity memorandum, with suggestions for advertising and news copy, plus TV-radio spots.
  - Pattern news releases, covering formation of local NEW committee and governmental proclamation.
- For additional information and costs on the above materials, see your league or utility. Or write: National Electrical Week Committee, c/o Fleishman-Hillard, Inc., 407 N. 8th St., St. Louis 1, Mo.

### From other sources:

- Display kit, including window poster, counter card, outdoor banner, truck poster and bumper strip.
  - Booklet. "New Step-by-Step Ideas to Help You Live Better . . . Electrically" runs 72-pages, promotes electrical living.
  - Folder, "Electricity in Your Home," features checklist for home electrical inspection report for use in high schools.
  - Folder, "Break-through to a New World," tells importance of the Week.
  - TV film clip runs 30 seconds, features NEW and Live Better Electrically. Suggested copy included.
  - Housepower displays. Separate insert pieces feature NEW.
  - Movies. A variety of industry progress and electric living movies are available.
- For additional information and costs on these materials, see your utility or league.



for—and how they and the company fit into the picture.

Perhaps at a meeting or by advisory letters, you can outline the industry's progress and how it has affected your company. It's also an opportunity to remind your staff of your company's traditions and its aims.

## 9. Tell your story to customers

One of the prime themes of NEW is how the industry serves the community and the nation. Take your story beyond your employees to your customers—reminding them of your facilities and services and of your interest in their welfare.

This might be done by direct mail letters or by the personal sales calls of your field men. Or you might want to hold an open house during the Week.

## 10. Conduct home wiring surveys

Using wiring worksheets (*see next pages*), NEW is an opportunity to provide a special service to your customers: an appraisal of their wiring systems and how they might be expanded—for convenience, safety and growth.

## 11. Use of advertising

Your advertising budget can be used to tell the NEW story, and to tell your story at the same time.

One suggestion is to use a mailing piece on some Week topic—electrical convenience, say. With this, you might tie in your services on improved home wiring or on one of your new products. Newspaper

advertising fits in, too—and again your company name can be associated with the NEW event.

## 12. Use Week displays

Your showroom and display window are adaptable for NEW displays. Perhaps you have a new lighting line or fixture. Display of this item could be built



around the Week and one or more of the industry's electric living promotions. Contests for the best NEW display are another possibility.

## 13. Promote all-electric homes

Openings of model electric homes can be timed for NEW. This will give your sales force an extra talking point, and the model home can be used to obtain feature space in the newspaper or for tie-in Week advertising (including the builder and others who participated in the project).

## 14. Kick-off spring activities

NEW is a good time to begin your spring promotions. Besides open houses for customers or the public, it offers an opportunity for tie-ins with showings of new products and equipment, and announcements of special sales campaigns.

**On the following 12 pages are three fold-out worksheets designed for appraising and selling up-to-date wiring systems. These worksheets can help you chart out recommendations—based on present system capacity and what capacity will be needed in the future. Once your recommendations are set, use these worksheets as a tool to explain them to the customer.**

- 1. RESIDENTIAL:** Use worksheet totals to fill in "Before" and "After" columns on first page. Branch circuit loads on worksheet will indicate excess capacity to be entered in on third column. Leave copy of table with homeowner.
- 2. COMMERCIAL:** Obtain from electrician or maintenance department (or by personal check) all information on existing system called for by tables. Show by riser diagrams recommended changes, with alternatives. Summarize circuit improvements in tables on first page.
- 3. INDUSTRIAL:** Obtain from plant electrician or engineer (or by personal check) all information on existing system called for by tables. Show by riser diagrams recommended changes, with alternatives. Summarize circuit improvements in tables on first page.

[illegible]



# WORKSHEET FOR <sup>TM</sup>HOUSEPO

## PLANNING GUIDE

Equipment	Typical Watts	Volts	Wires	CB or Fuse Rating	Notes
<b>KITCHEN</b>					
Range Oven, built in Range top	12000 4500 6000 or 3300	120/240	3#6 3#10 3#10 3#12	50 30 30 20	Special purpose receptacle if not direct-connected
Dishwasher Waste disposer	1200 300	120	2#12	20	Grounding receptacle if not direct-connected
Broiler Fryer Coffeemaker Toaster Waffler Skillet	1500 1300 1000 1000 1000 1000	120	2#12	20	Parallel or grounding receptacle If used regularly at one location, appliance should have separate circuit
Refrigerator Freezer	300 350	120	2#12	20	Separate ckt recommended feeding these appliances only
<b>LAUNDRY</b>					
Washing machine	1200	120	2#12	20	Grounding receptacle; separate ckt recommended
Dryer	5000	120/240	3#10	30	Must be grounded
Ironer	1650	120	2#12	20	Parallel-grounding receptacle
Hand iron	1000	120	2#12	20	Provide for use in other locations
Water heater	3000	—	—	—	Consult utility
<b>LIVING AREAS</b>					
Portable lighting Television	1200 300				One ckt per 500 sq ft Should not be connected to appliance ckt
Portable heater Workshop	1300 1500	120	2#12	20	Separate ckt recommended Grounding receptacle; separate ckt recommended
<b>FIXED UTILITIES</b>					
Fixed lighting Sump pump Heating plant	1200 300 600	120	2#12	20	One ckt per 1200 watts Parallel grounding receptacle Local code may require separate ckt
Fixed bathroom heater Attic fan	1500 300				Direct-connected May be direct-connected
Air conditioner, ¾ hp Air conditioner, 1½ hp Central air conditioner	1200 2400 5000	120/240 120/240 120/240	3#12 3#12 —	20 20 —	Individual ckt required Use approved receptacle Follow mfr's recommendations

## PANEL

1. Outline and  
on panel sk

2. Indicate ge  
provided.

Service: —

Service Condu

Service Entrance

Circuit | L

- 1
- 3
- 5
- 7
- 9
- 11
- 13
- 15
- 17
- 19
- 21
- 23

## PLUS I

- Dimme
- Sun La
- Interco
- Fire Al
- Garag
- Low-V
- Valanc
- Night
- Sports
- Multipl
- Garder

# POWER MODERNIZATION

ELECTRICAL CONSTRUCTION  
AND MAINTENANCE

ELECTRICAL WHOLESALING

## PANELBOARD SCHEDULE

Line and number circuit breaker or fuse locations  
panel sketch below.

Indicate general nature of connected load in blanks  
provided.

\_\_\_\_\_ Amps \_\_\_\_\_ Phase \_\_\_\_\_ Volts

Conductors: (2, 3, 4) AWG No. \_\_\_\_\_ Type \_\_\_\_\_

Entrance Conduit: \_\_\_\_\_ Inch

Load	Panel	Load	Circuit
_____	_____	_____	2
_____	_____	_____	4
_____	_____	_____	6
_____	_____	_____	8
_____	_____	_____	10
_____	_____	_____	12
_____	_____	_____	14
_____	_____	_____	16
_____	_____	_____	18
_____	_____	_____	20
_____	_____	_____	22
_____	_____	_____	24

## US ITEMS TO CONSIDER:

Dimmers

Sun Lamps

Intercom System

Fire Alarm System

Garage Door Opener

Low-Voltage Switching

Valance or Cove Lighting

Night (Stairway) Lighting

Sports and Game Lighting

Multiple TV Antenna Outlets

Garden, Walk and Driveway Lighting

## THE ELECTRICAL WIRING IN THIS RESIDENCE PROVIDES HOUSEPOWER FOR

BEFORE | AFTER  
MODERNIZATION

and  
can be  
extended  
for

Range			
Oven, built in			
Range top			
Dishwasher			
Food waste disposer			
Kitchen receptacles (sufficient for feeding 2 appliances at same time)			
Clothes dryer    regular			
hi-speed			
Automatic washer			
Water heater			
Ironer			
Electric space heaters in			
Room air conditioners in			
Central air conditioner			
Attic fan			
Work shop			
Work center			

call the undersigned  
for additions to your wiring system

Date \_\_\_\_\_

Signed \_\_\_\_\_

Electrical Contractor

Address \_\_\_\_\_

Phone \_\_\_\_\_









## ELECTRICAL WHOLESALING

<b>SERVICE</b>		Connected Load (kva) after Modernization	Growth Capacity kva
Description			
Plans for Extension of Main Distribution Equipment			
Date		Electrical Contractor	
Address			
		Phone	

Doubling voltage will double capacity of existing risers, if insulation is in good condition.



# DISTRIBUTION SYSTEM — EXISTING

SERVICE EQUIPMENT							Show by block diagrams existing system plus re equipment, feeders, panelboards and transform number of active and spare circuits, and ratings	
Service Rating	volts	phases	conductors	size	type			
Main Switch	volts		poles		amps			
Main fuses or circuit breakers			frame		amps			
Raceway								
MAIN DISTRIBUTION EQUIPMENT								
Description and ratings								
FEEDERS								
No. or Symbol	No. Conductors	Size	Type	Raceway	Rating (amps)	Present Load (amps)		
Notes:								
PRESENT LOAD AND CAPACITY								
Lighting		kva	Service capacity		kva			
Motors		kva	Peak demand		kva			
Heating		kva	Off-peak demand		kva			
Misc.		kva	Average power factor					
Total connected load		kva	PF capacitors in use		kvar			
Notes:								
kva service capacity = rated voltage x rated current x 1.732 kva motor load = motor hp x 0.746 kva demand = kw demand/power factor								
Additional load to be added immediately						kva		
New total connected load						kva		
Estimated new peak demand						kva		

## EXISTING AND PROPOSED

## RISER DIAGRAMS

plus recommended improvements. Include service equipment, main distribution transformers. Indicate ratings of all equipment, size and type wire, raceway, and ratings of circuits.

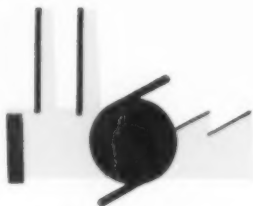
This image shows a full page of blank graph paper. The grid consists of small, equal-sized squares formed by thin, light gray lines. There are approximately 20 columns and 20 rows of squares across the entire page. The background is white, and the grid covers almost the entire area, leaving a small margin at the top and bottom.

### TYPICAL LIGHTING LOADS

- |           |   |
|-----------|---|
| <b>2</b>  | <b>watts per sq ft</b><br>Receiving, shipping<br>Rest rooms                     |
| <b>3</b>  | <b>watts per sq ft</b><br>Dining areas<br>File rooms, vaults<br>Reception rooms |
| <b>5</b>  | <b>watts per sq ft</b><br>Offices<br>Lobbies<br>Kitchens                        |
| <b>6</b>  | <b>watts per sq ft</b><br>Reading rooms<br>Show rooms<br>Counter displays       |
| <b>7</b>  | <b>watts per sq ft</b><br>Very fine work<br>Drafting rooms                      |
| <b>15</b> | <b>watts per running ft</b><br>Halls, corridors                                 |
| <b>25</b> | <b>watts per running ft</b><br>Wall display cases                               |

## RECOMMENDATIONS

kva	New capacity of service required for immediate additions	kva	Additional PF capacitors recommended	kvar
kva	Capacity of service recommended	kva	Notes:	
kva	At present demand factor, this capacity will permit future additional load totalling	kva		



# WORKSHEET FOR **INDUSTR**

<b>PANELBOARDS</b>			Active Circuits after Modernization	Growth Capacity Circuits
No. or Symbol	Total Circuits	Description		

<b>FEEDERS</b>	
No. or Symbol	Description

UTILIZATION  Motors		Connected Load		EQUIPMENT  Lighting-Heating		Connected Load	
		Before	After			Before	After
		Modernization				Modernization	
Motorized Equipment (horsepower)			Lighting Equipment (kva)				
Air conditioning			General				
Compressors			Floodlights				
Conveyors			Portable				
Cranes, hoists			Signs				
Elevators			Stairway, exit				
Fans, blowers			Supplementary				
Motor-generators							
Office machines			Total lighting kva				
Production machinery			Electric Heating Equipment (kva)				
Pumps							
Tools			Furnaces				
Valves			Kitchen equipment				
			Ovens				
			Production machinery				
			Space heaters				
			Tools				
Total motor horsepower			Total heating kva				





### **DISTRIBUTION SYSTEM – EXIS**

SERVICE EQUIPMENT							Show by block diagrams existing system plus re equipment, feeders, panelboards and transform number of active and spare circuits, and ratings	
Service Rating	volts	phases	conductors	size	type			
Main Switch	volts	poles	amps					
Main fuses or circuit breakers			frame	amps				
Raceway								
MAIN DISTRIBUTION EQUIPMENT								
Description and ratings								
FEEDERS								
No. or Symbol	No. Conductors	Size	Type	Raceway	Rating (amps)	Present Load (amps)		
Notes:								
PRESENT LOAD AND CAPACITY								
Lighting	kva	Service capacity	kva					
Motors	kva	Peak demand	kva					
Heating	kva	Off-peak demand	kva					
Misc.	kva	Average power factor						
Total connected load	kva	PF capacitors in use	kvar					
Notes:							Additional load to be added immediately  New total connected load  Estimated new peak demand	
kva service capacity = rated voltage x rated current x 1.732 kva motor load = motor hp x 0.746 kva demand = kw demand/power factor								

# EXISTING AND PROPOSED

## RISER DIAGRAMS

plus recommended improvements. Include service equipment, main distribution transformers. Indicate ratings of all equipment, size and type wire, raceway, ratings of circuits.

## TYPICAL LIGHTING LOADS

2

watts per sq ft

Special processes:  
rough work

Receiving, shipping

Locker, shower and  
washrooms

Foundries

3

watts per sq ft

Special processes:  
medium-fine work

Core making

Polishing, burnishing

Storerooms,  
stockrooms

Packing, boxing

Dining areas

Reception room

File room, vault

4 1/2

watts per sq ft

Special processes:  
fine work

Assembly lines

Inspection

Machine shops

Sheet metal work

5

watts per sq ft

Offices

Kitchen

7

watts per sq ft

Drafting rooms

10

watts per running ft

Aisles, passageways

## RECOMMENDATIONS

kva	New capacity of service required for immediate additions	kva	Additional PF capacitors recommended	kvar
kva	Capacity of service recommended	kva	Notes:	
kva	At present demand factor, this capacity will permit future additional load totalling	kva		

### EXISTING AND PROPOSED

## RISER DIAGRAMS

us recommended improvements. Include service equipment, main distribution transformers. Indicate ratings of all equipment, size and type wire, raceway, ratings of circuits.

[illegible]

### TYPICAL LIGHTING LOADS

- |       |  |
|-------|--|
| 2     | watts per sq ft                        |
|       | Special processes:<br>rough work       |
|       | Receiving, shipping                    |
|       | Locker, shower and<br>washrooms        |
|       | Foundries                              |
| 3     | watts per sq ft                        |
|       | Special processes:<br>medium-fine work |
|       | Core making                            |
|       | Polishing, burnishing                  |
|       | Storerooms,<br>stockrooms              |
|       | Packing, boxing                        |
|       | Dining areas                           |
|       | Reception room                         |
|       | File room, vault                       |
| 4 1/2 | watts per sq ft                        |
|       | Special processes:<br>fine work        |
|       | Assembly lines                         |
|       | Inspection                             |
|       | Machine shops                          |
|       | Sheet metal work                       |
| 5     | watts per sq ft                        |
|       | Offices                                |
|       | Kitchen                                |
| 7     | watts per sq ft                        |
|       | Drafting rooms                         |
| 10    | watts per running ft                   |
|       | Aisles, passageways                    |

## RECOMMENDATIONS

kva	New capacity of service required for immediate additions	kva	Additional PF capacitors recommended	kvar
kva	Capacity of service recommended	kva	Notes:	
kva	At present demand factor, this capacity will permit future additional load totalling	kva		

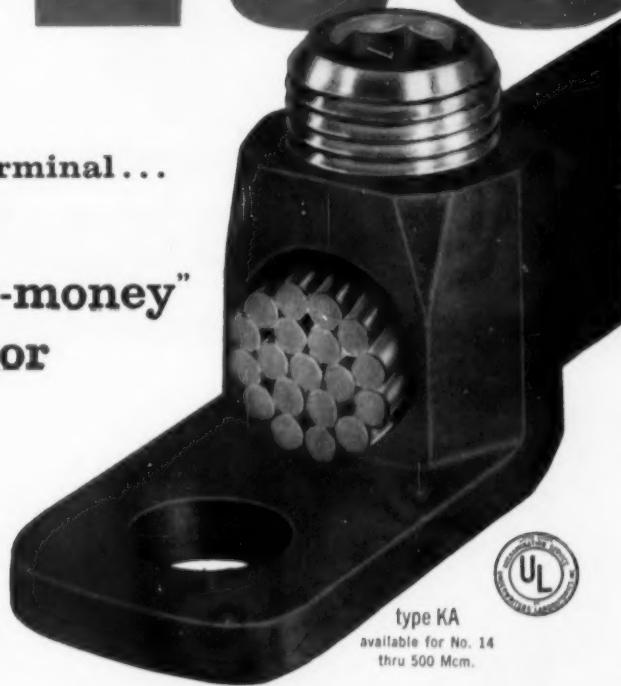
**STRONGEST**—high-strength copper alloy for rugged strength.

**MOST COMPACT**—the snuggest lug . . . easier terminating in tight spots. A cinch to tape. **FASTEST**—insert cable, tighten smallest size with screwdriver; larger sizes with Allen wrench.

**SAVINGS**—through **KA-LUG'S** ease of installation, greater electrical dependability . . . as well as low initial cost.

# KA-LUG

new quality in a  
low-cost terminal...  
the NEW  
"most-for-your-money"  
connector



type KA  
available for No. 14  
thru 500 Mcm.



try it!

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Dept. M

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Norwalk, Connect. • Toronto, Canada • Other Factories: New York, Calif., Toronto • Export: Phillips Export Co.

**EXCLUSIVE "INCH-MARK"**® makes quick measurement a cinch. Every length of Republic ELECTRUNITE® E.M.T. is like a 10-foot rule—marked off from end to end in *feet* and *inches*. You avoid the clumsy problem of a flat rule on a round tube . . . eliminate guesswork.



**EXCLUSIVE "GUIDE-LINE"** extends full length of tubing. By properly aligning with calibrations on Republic bender, bends are kept in the correct plane, thus avoiding costly "wows". Both "Inch-Marked" and "Guide-Lined" features come in ½", ¾", 1" and 1¼" sizes.



## THE BEST COSTS



**GALVANIZING** protects every inch of Republic ELECTRUNITE E.M.T. The special galvanized finish will not chip or flake when tube is bent. And because ELECTRUNITE E.M.T. is threadless, there's no unprotected steel exposed at the joint, no wrench marks to damage the finish.



**UNIFORM CONCENTRICITY** provides a truly round tube for snug-fitting connections that completely shut out moisture and concrete—protect against fire. Easy-to-use fittings that make sturdy rain- and concrete-tight joints are available in a complete range of types and sizes.

# REPUBLIC



*World's Widest Range of Standard Steels*



**EXCLUSIVE "INSIDE-KNURLING"** reduces friction, thanks to inside ball-bearing surface—makes wire pulling as much as 30% easier. ELECTRUNITE E.M.T. is made to Underwriters' Laboratories Standards—is approved by the National Electrical Code for concealed, open and concrete construction—meets A.S.A. Specification C80.3 and Federal Specification WW-T-806.



**UNIFORM DUCTILITY** in every foot of Republic ELECTRUNITE E.M.T. assures smooth, accurate bends *every time*—with no costly kinks. Welded by the famous Electrunite Process, this quality conduit is 100% Republic—from ore to finished product. And rigid manufacturing-controls assure *complete* uniformity.



## LESS INSTALLED



**INSTALLATION ADVANTAGES OF E.M.T.** make it your most practical raceway. To make tight joints, you simply tighten the fitting, not the entire run—a real aid where space is limited. Furthermore, it's lightweight, easy to handle. A bundle of ½" size—100 feet—weighs only 32 pounds.



**COMPLETE INFORMATION** on Republic ELECTRUNITE E.M.T., Rigid Steel Conduit and Dekoron®-Coated E.M.T. and Conduit for severe corrosive atmospheres is available upon request. Simply check desired material in coupon below. And remember . . . you'll be ahead when you specify Republic ELECTRUNITE E.M.T. on your next job, because—the *best* costs *less* installed.

# STEEL

*and Steel Products*

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Steel and Tubes Division  
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Gentlemen: Please send me additional information on:  
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☐ Dekoron-Coated E.M.T. and Dekoron-Coated Rigid Steel Conduit

Name \_\_\_\_\_ Title \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

© 3011

Something  
**NEW**  
Has Been Added  
To—

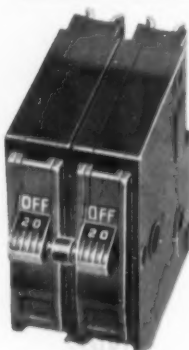
# QO—FINEST BREAKER EVER BUILT!

## 1-POLE



*15-50 Amps*

## 2-POLE



*15-70 Amps*

## 3-POLE



*15-50 Amps*

**ONE, TWO and THREE POLES GO ANYWHERE—UNLIMITED!**

Square D's NEW 3-pole QO  
crashes the 3-phase price barrier!

Square D's 2-pole QO Now extended  
to 70 Amperes for heavier loads!

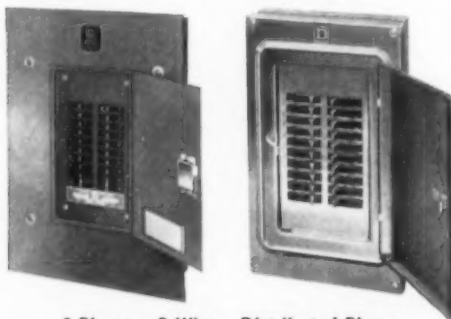
### QO FEATURES

- One size per pole. No space penalty
- Plug-in mounting. No time-wasting screws
- Silver-plated connections equal to best bolted design
- Switches like a "T" rated switch
- Temperature-corrected. No nuisance tripping
- Meets Federal Spec WP-131A—Class A
- Box lugs on line, load and neutral
- Rejection "ears" prevent overprotecting mistakes

### NO CALL BACKS

Write for QO Bulletin. Address Square D Company,  
6060 Rivard Street, Detroit 11, Michigan.

### SAME BREAKER...PANELBOARDS & LOADCENTERS



1 Phase—3 Wire—Distributed Phase  
3 Phase—4 Wire—Distributed Phase  
**2 THROUGH 42 CIRCUITS**

**NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!**



# SQUARE D COMPANY

# Motor Shops

## Commutator Slotter For Rewind Jobs

An accurate cutting device, fabricated in the shops of the Consolidated Electric Motor Co., New York City, is used for slotting commutator risers in preparation for rewinding.

Removal of the nut and the first of two metal tapered spacers from the shaft permits the commutator to be placed on the shaft with a

snug fit against a second spacer. Replacing the first spacer and tightening the nut forces the commutator against the two tapered surfaces, holding it fast to the shaft.

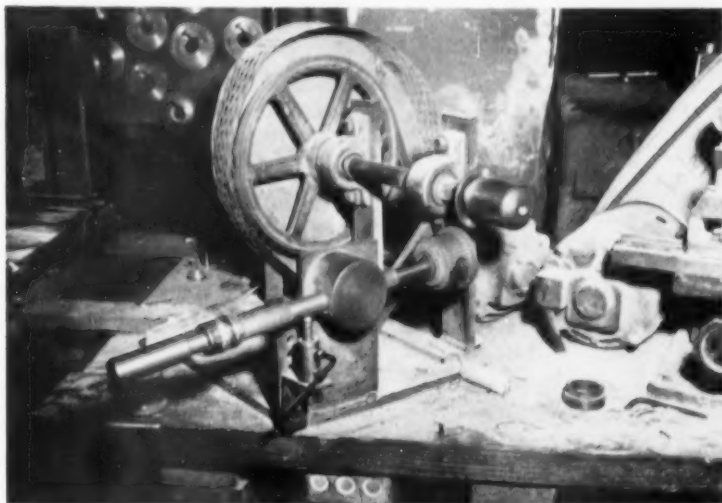
The sleeve holding the shaft is pivoted on the vertical base so that commutators with varying diameters can be accommodated. Once the depth of cut is determined, the vertical stop at the lower end of the shaft may be adjusted with an

Allen wrench to limit the shaft's travel about the pivot.

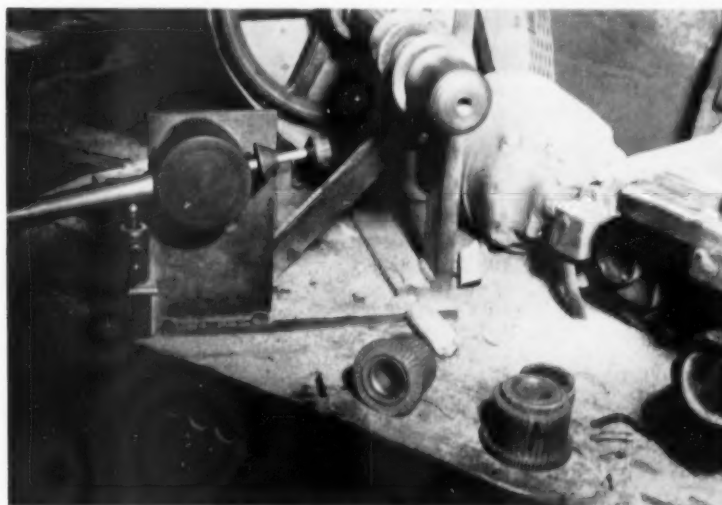
An additional sleeve at the base of the shaft is preset using an Allen wrench to limit the horizontal movement of the shaft. In operation, the shaft with the commutator fixed in place is pushed horizontally by hand through the pivoted sleeve until the commutator risers make contact with the motor-driven circular cutter. Thus, with the two stops set to limit travel, the length and depth of cut in each riser will be identical.

Cutters, mounted on a board behind the machine, are available in several sizes, depending upon the size wire to be used. To insure a good fit, a cutter one size smaller than the wire used is generally selected. To extend the range of armatures which may be slotted, several sizes of tapered spacers are on hand to compensate for the varying diameters of holes in the commutators.

Use of the device reduces work time, improves the appearance of the finished commutator, and guarantees a more permanent connection between coil ends and commutator segments.



**COMMUTATOR CUTTER** used by Consolidated Electric Motor Co., New York, insures accurate slotting of risers to receive coil ends for connection to commutator segments. Slotted commutator is shown in position on shaft.



**TAPERED SPACERS**, shown in place on shaft, are available in various sizes to match hole through commutator. Commutators before and after slotting are in foreground.

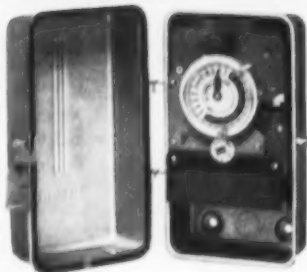
## Shop Efficiency Boosted by Use of Modern Equipment

A continuous band saw is one of numerous useful items of equipment installed and used in the shop of the Buffalo Electric Company to promote their wide-scope practically self-sufficient brand of customer service. This unit, equipped with a 4-hp motor, has a 3-ft useful throat, making it applicable for a wide variety of electrical and mechanical construction or prefabrication projects.

Another practical item is a shop-constructed dolly that supports an oxy-acetylene burning rig. Fitted with a sturdy rack for the tanks, a shelf for holding extra electrodes and flame nozzles, wheels for movement and a bar handle for motivation, the rig may be easily moved around the shop or pushed aside when not in use.

Other equally helpful items of

## BUY RELIABILITY... HEAVY-DUTY GENERAL ELECTRIC TIME SWITCHES



Your best buy in heavy-duty time switches is the General Electric TSA-40. You get the dependability and long service life you require plus these outstanding features:

- Off-the-shelf delivery means you can get the TSA-40 *when you need it*.
- More wiring space and removable cover simplify installation and maintenance.
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- Exclusive contact shearing action breaks welds and keeps contacts clean.
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Contact your local G-E time switch distributor or send for free bulletin today!

SECTION B584-B  
GENERAL ELECTRIC CO.  
SCHENECTADY 3, N. Y.

Please send me free bulletin GEA-6468A on the TSA-40 time switch.

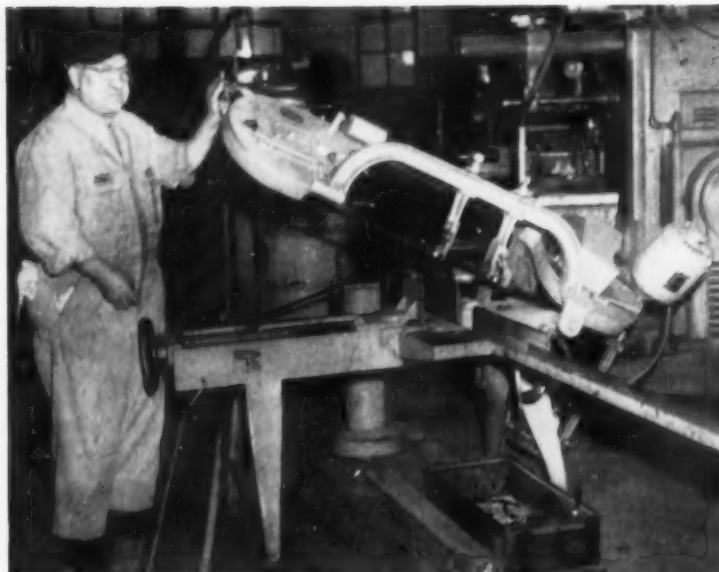
NAME \_\_\_\_\_

POSITION \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_



**METAL CUTTING** related to pre-fabricating motor mounts, switchgear enclosures, structural framing, conduit systems and the like is performed quickly and accurately by this 1/2-hp continuous bandsaw in the shop of the Buffalo Electric Co.



**BURNING RIG** is compact assembly with rack for nozzles and electrodes, stand for tanks, wheels for movement and bar framework for guidance.

equipment in this progressive shop include drill presses and grinders, lathes and wire insulation skinning wheels, commutator slot routers, testing boards and instruments.

The shop is laid out for logical progression of work, is lighted by continuous rows of 2-lamp industrial fluorescent fixtures, and is served by an overhead monorail rolling hoist system that runs the full length of the shop to facilitate the vertical and horizontal movement of loads within this active service area.

Dip tanks for cleaning metal parts, painting and varnishing equipment and hand tools round out the shop's facilities.

## Bake Oven Features Automatic Loading

A completely automatic, recycling, high-velocity, gas-fired bake oven featuring automatic loading and unloading from roller conveyor lines is an important piece of equipment in the new semi-automatic motor repair line recently installed in General Electric's service shop in Chicago. The specially designed unit cuts the baking time for rewound stators from six to two hours and plays a vital part in effecting a 50% reduction in normal motor repair time at the shop. The oven indexes every half-hour, opens its doors to take in freshly dipped stators and move out finished stators ready for assembly. No operators are needed to load and unload the unit.

Placed in a conveyor line going from a dip tank to the moisture-proofing and assembly table, the oven is 12 ft long, 9½ ft high, and has 4-ft wide lift-doors at each end. Stators are carried through the oven on a motor-operated endless conveyor whose operation is timed so that it takes just two hours for a unit to travel the length of the oven. The conveyor extends several feet beyond each end of the oven so it can pick up the load from a roller conveyor at one end and discharge baked motors to a roller conveyor at the other end.

Stators are placed on shallow metal trays (24 in. by 30 in.) after dipping. While traversing the



# How S&C "JOB MATCHED"

## Metalclad Switchgear

# saved 50%

## for Twin Disc Clutch

Typical high-voltage power supply systems for industrial plants are rarely exposed to faults, either transient or permanent. For that reason they can use the simple radial form of power distribution, and dispense with high-priced protective equipment that provides automatic reclosure against faults. Reliable interruption of permanent faults and occasional switching is all that is required; and this is provided by S&C Metalclad Switchgear.

The plans for doubling the high-voltage power system capacity at Twin Disc Clutch Company included S&C Metalclad Switchgear for the high-voltage switching center... the 3-unit assembly is shown. In addition to the substantial economies resulting from elimination of complex equipment, S&C gear saved valuable ground space normally required for an open structure.

Experienced S&C engineers will be glad to assist you in building economy into your high-voltage power supply.

*Specialists in High-Voltage Switchgear for  
Electric Utilities since 1910*

## S&C ELECTRIC COMPANY

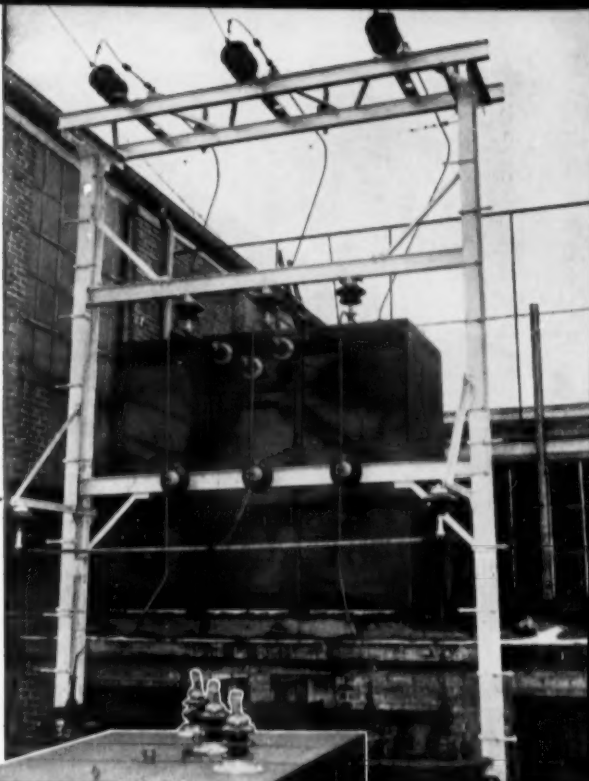
4433 RAVENSWOOD AVENUE  
CHICAGO 40, ILLINOIS, U. S. A.

In Canada:

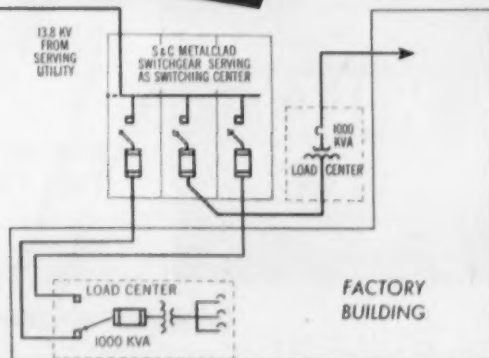
S&C Electric Canada, Ltd., 8 Vansco Rd.  
Toronto 14, Ontario



Diagram at right shows use of S&C  
Metalclad Switchgear in radial-  
type circuit at Twin Disc  
Clutch Company



Exum  
French,  
President,  
B. & F. Hi  
Line Construc-  
tion Corp., Rock-  
ford, supervised  
the installation.



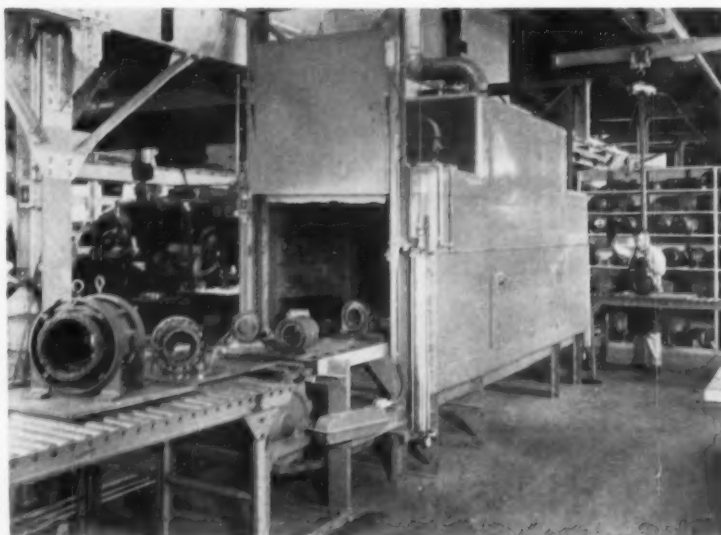


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- **Pioneers in Fluorescence** since its inception.
- **Modern, functional designs** to harmonize with any architectural motif.
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- **Units designed for quick, easy erection.** A minimum of on-the-job assembly.
- **Patented E-Z Servicer.**
- **Designed and completely manufactured by WILEY** with ETL Certified Electrical Components.

*District Sales Engineers Available  
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BUFFALO 7, N. Y.  
Underwriters' Approved  
IBEW (A F of L)



**AUTOMATIC INDEXING** is a feature of this completely automatic, gas-fired, bake oven at General Electric's Chicago service shop. Every half-hour oven doors open and conveyor discharges one pan at front end and picks up newly dipped stators at rear. Two-hour bake and automatic operation combines with newly integrated system to cut shop repair time for ac motors by some 50%.

oven, these trays ride on the inverted channel-iron "slats" of the conveyor. Every half-hour, both doors of the oven open automatically and one tray is ejected while another is picked up. G.E. shop personnel report that the new oven operates at considerably higher temperatures than manually loaded ovens and that, with its fast recuperating power, it regains its temperature loss within a few seconds after the doors open and close.

The 2-hour baking period is geared to the higher oven temperatures and the use of a newly developed G. E. varnish which is reported to produce a high quality impregnation. Both baking time and conveyor speed can be varied, if desired, to meet specific conditions.

Once the baked stator leaves the oven, it goes by roller conveyor to the moisture-proofing table where it is treated with Dri-Film water repellent. It then travels to the reassembly stage where rotor, end-bells, bearings and other needed parts are installed. While still on the roller conveyor, the motor is spray painted and passed on to the test bench. If all is well, the motor then is ready for delivery.

O'Brien, Inc., of New York City. Built into one end of the shop switchboard, the test equipment furnishes potentials up to 3000 volts for use in checking the effectiveness of the insulation of newly wound motors.

The 115-volt input to a 3000/115-volt transformer mounted behind the board is varied by turning a wheel on the face of the panel. The axle of the wheel is connected directly to the shaft of an old laminated-core dc motor. Turning the wheel rotates the motor armature through 90 degrees, varying the interaction between the magnetic flux of the armature and stator fields



**HIGH POTENTIAL** is adjusted at 2 kv by Gus Seegmuller, S. J. O'Brien motor shop foreman. Red light at top of panel indicates when circuit is energized; test leads to motor are plugged into jacks at bottom of board.

### **Homemade High Pot Test Furnishes 3 kv**

A unique homemade high-potential breakdown test is used by the electric motor repair shop of S. J.

# ONLY HEINEMANN CIRCUIT BREAKERS give you all **THREE**

**1**

**A DEFINITE RATING . . .**  
unaffected by temperature. A 20  
ampere rating means 20 amperes  
of safe, usable capacity. There is  
no de-rating of Heinemann Cir-  
cuit Breakers.



**2**

**INVERSE TIME DELAY . . .**  
prevents nuisance power inter-  
ruptions . . . permits starting in-  
rush and harmless, temporary  
overloads. Gives maximum pro-  
tection without inconvenience.



**3**

**SELF-ADJUSTING  
TIME ELEMENT . . .**  
varies time delay, not the rating or  
instantaneous trip point, to allow  
more time to make cold starts or  
to shorten delay under dangerous  
heat conditions.

INFORMATIVE BOOKLET: "What You Should Know  
About Circuit Breakers" . . . Send for your free copy.

**HEINEMANN**

*Circuit breakers*

HEINEMANN ELECTRIC COMPANY  
132 PLUM STREET  
TRENTON 2, N. J.

**design by mcPhilben**

for The New House of Seagram

Superbly contemporary in design



43-40



**Architects:**  
Mies van de Rohe  
& Philip Johnson  
**Associate Architects:**  
Kahn & Jacobs  
**Electrical Engineers:**  
Clifton E. Smith  
**Lighting Consultant:**  
Richard C. Kelly  
**Electrical Contractors:**  
Fischbach & Moore, Inc.

Selected to light the stairways of the new House of Seagram in New York, the McPhilben 43-40 wall bracket offers these exclusive advantages: solid cast aluminum construction...gleaming satin finish...dust-free and bug-tight operation...a larger, threaded tapered globe which gives greater diffusion, lower operating temperatures and longer lamp life.

Wall and ceiling units are made in 100 and 200 watt sizes. Both are available in a UL approved vapor-tight series and may be fitted with cast aluminum protective guards.

See the McPhilben sales representative in your area or write for full 43-40 specifications to: McPhilben Lighting Co., 1331 Willoughby Ave., Brooklyn 37, N. Y.

Representatives in major cities • Stocked by electrical wholesalers

from zero to maximum. This variable transformer action produces a variable input to the transformer and a 0-3000-volt output.

The transformer output is brought to jacks at the bottom of the switchboard panel. Test leads plugged into the jacks are then clamped to the motor under test—one to the end of a coil lead, the other to the motor frame. Voltage applied is in accordance with NEMA standard breakdown test.

Any direct short in the motor under test, constituting a shorted secondary on the transformer, will result in strongly opposing fields in the dc motor. The resulting motor action will automatically rotate the armature back to its neutral position, dropping the transformer input and output to zero.

## Armature Brackets Save Bench Room

Rewinding of small armatures is accomplished without taking up valuable bench space in the shop of the Consolidated Electric Motor Co., New York City. Plates secured to the front edge of the benches are slotted to receive brackets which support the armature out away from the bench. Tools, charts, orders, etc., can thus be kept on the bench within easy reach, and the entire armature is readily accessible at all times.

When work on the armature is completed, bolts holding the brackets to the bench are loosened, the brackets are slid out of the slots, and normal use may be made of the bench.



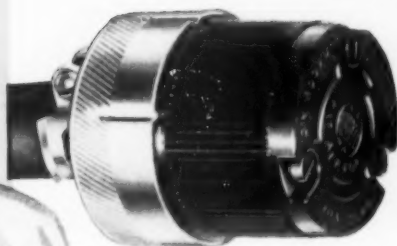
**SLOTTED PLATE** on forward edge of bench holds armature brackets, permitting all work on armature to be done away from bench and leaving area clear for materials and tools.

*Cuts wiring time 1/3!*

NEW, SUPER

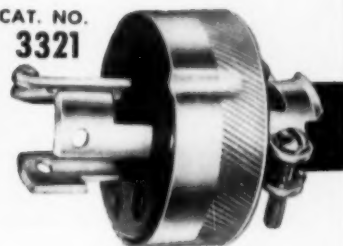
**Twist-Lock<sup>®</sup>**

SERIES 3000



CAT. NO.  
**3323**

CAT. NO.  
**3321**



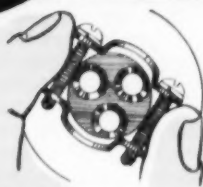
ONE out of every THREE valuable wiring seconds **SAVED**, thanks to Hubbell's new screwless **PRESSURE-GRIP** terminals. This exclusive cost-saving and labor-saving idea completely eliminates the conventional "wrap around—screw down" binding post method. Wire ends are simply pressed into their individual pockets and are locked securely when the dead front section is positioned. Tests prove it's the safest, most secure, most fool-proof connection there is. Remember, it **PAYS** to have **GOOD CONNECTIONS**. Hubbell connections, that is.

Write for folder

*Completely Wired  
in 6 easy steps*



**1.** Use knurled section on shell as strip gage. Insulation left on wire ends can simplify insertion by containing strands.



**2.** Spread cord clamps and insert conductors into holes making sure green (ground) conductor enters hole marked GR.



**3.** With cord pressed in firmly, tighten cord clamps to maintain position.



**4.** Judge approximate wire length and snip off excess.



**5.** Bend each conductor outward into its individual pocket and press firmly into place.



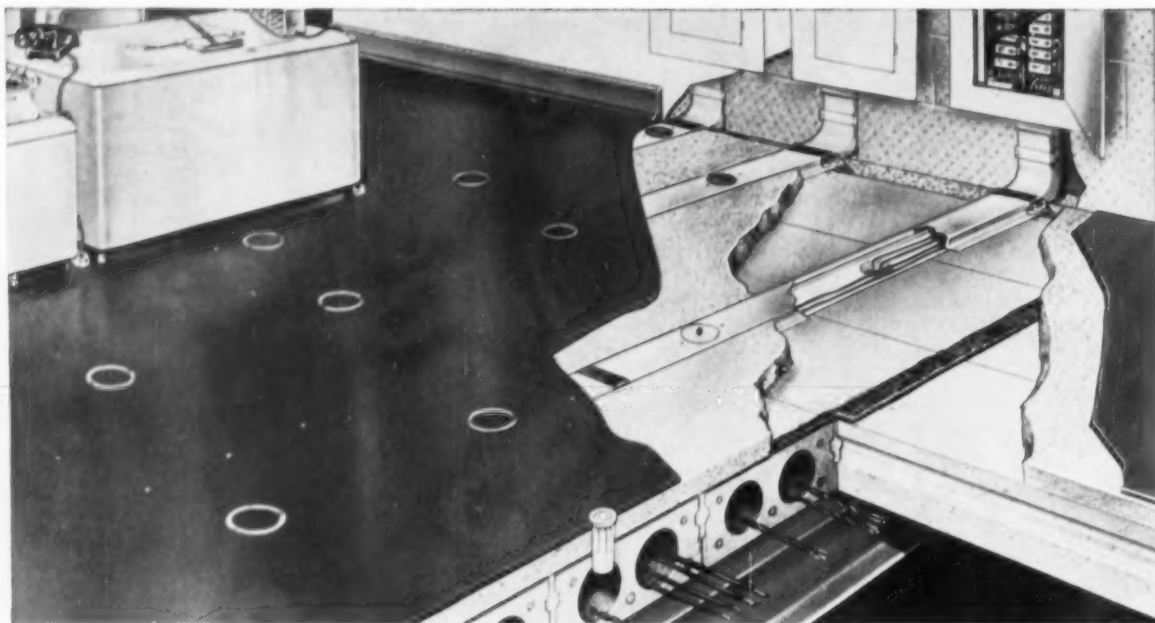
**6.** Insert dead front into keyed shell and engage the two sections securely by tightening each screw alternately until all are firmly seated.

**Harvey Hubbell, INC.**  
DEPT. C-1 BRIDGEPORT, CONNECTICUT

FACTORY WAREHOUSE LOCATIONS ASSURE NATIONWIDE STOCK AVAILABILITY

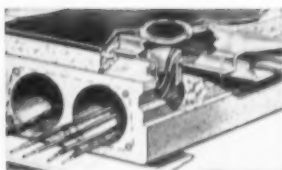
Bridgeport 2, Connecticut  
State and Bostwick Streets  
Chicago 7, Illinois  
37 South Sangamon Street  
Los Angeles 13, California  
103 North Santa Fe Avenue  
San Francisco, California  
1675 Hudson Avenue  
Dallas 7, Texas  
1111 Dragon Street





Hollow cells in concrete floor are electrical raceways. Cells are electrified by header ducts which run from panel box across floor at right angles to the cells. Floor outlets install at any point along cell.

## Now! Electrical Availability



Wiring drops from header duct into cell at handhole junction.



Wiring then runs either way through cell to floor outlet.



To install outlet: drill hole at outlet location.



Next, install fitting in floor and fish wire.



Last, attach electric or telephone outlet box.

### Gives Unlimited Distribution

The hollow cells in a Flexicore precast concrete floor become approved electrical raceways with this new underfloor distribution system. The cells are large circular voids, spaced 5½" or 8" on centers, depending on the Flexicore unit selected. Standard header duct is 4" wide and installs directly on the precast floor. A concrete fill, usually 1½", is leveled to the top of the header duct. Finish floor conceals the header. Handhole junction cover plates give access to the system at the intersection of header and cell.

Floor outlets install quickly at any point along a cell, giving unlimited electrical availability. Any number of systems can be used; electrical, telephone, intercom, and any others desired.

The use of this system is covered by Article 358 of the 1956 National Electrical Code. Electrical fittings are manufactured by the Conduflor Corporation, Cleveland, Ohio.

# flexicore<sup>®</sup> ELECTRIFIED FLOORS

with Conduflor<sup>®</sup> Electrical Fittings



OFFICE BUILDING MANUAL  
Flexicore Electrified Floors  
New 32-page booklet  
available to architects,  
engineers and contrac-  
tors. Write nearest man-  
ufacturer for your copy.





Wisconsin Farm Bureau Building Cooperative office building, Madison, Wisconsin. John J. Flad & Associates, architects. Berman Electric Company, electrical contractor.



Continental Casualty Building, Toronto. Marani & Morris, architects. H. H. Angus and Associates, mechanical and electrical engineers. Canadian Comstock Co., Ltd., electrical contractor.



National Cash Register Engr. Research Bldg., Dayton. Lorenz & Williams, architects. Schweiger, Heapy & Assoc., consulting mechanical engs. Wagner-Smith Co., elect. contr.



Erection of Flexicore concrete structural floors is fast on steel frame, above, or on concrete frame or masonry walls.



Smooth, safe work deck is ready for other trades 24 hours after erection of floor. Flexicore clear-spans from girder to girder.



Structural concrete floor requires no extra fire-proof ceiling. Columns, girders and beams get usual fireproofing treatment.

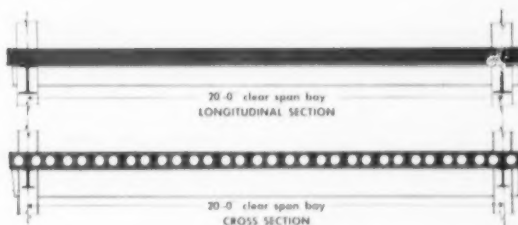
## in Flexicore Precast Floors

### Needs No Fireproofing

The structural floor of this system is formed of monolithically cast Flexicore concrete units, and requires no fireproofing. Underwriters Laboratories gives a 3-hour fire rating to an 8" Flexicore floor with 1½" concrete topping.

The basic advantages of this system for office building construction include savings in job time and investment. The dry erection of the lightweight units saves construction time. Less structural framing is required because of long, clear spans. Plaster fireproofing on the underside of the floor is eliminated and concrete topping is reduced in thickness to 1½" because of the fire-resistant qualities of the structural floor itself. As a by-product of these savings, overall job time is reduced, providing earlier occupancy.

The Flexicore method is a time-tested system and has been used on over 24,000 buildings in the United States and Canada.



### LONG SPANS SIMPLIFY STRUCTURAL DESIGN

The use of Flexicore precast concrete floors in office buildings permits 20' x 20' clear span bays. This means simple framing without intermediate beams, and results in savings in steel and in total weight. The new Flexicore Office Building Manual contains design information, including properties of the Flexicore slab, load curves, special design conditions and design examples.

### WRITE OR PHONE YOUR NEAREST FLEXICORE MANUFACTURER

**ALABAMA,**  
Birmingham 1, PO 630  
The Alabama Cement Tile Co.

**COLORADO,** Denver 1, PO 366  
Flexicore Company of Colorado

**FLORIDA,** Tampa, PO 2189  
Universal Concrete Pipe Co.

**ILLINOIS,** Chicago  
PO 277, Franklin Park  
Mid-West Concrete Pipe Co.

**INDIANA,** E. Chicago, PO 539  
Calumet Flexicore Corporation

**MICHIGAN,** Livonia, PO 2006  
Price Brothers Company

**MINNESOTA,** St. Paul E-4  
Molin Concrete Products Co.

**MISSOURI,** St. Louis Flexicore  
PO Box 552, Collinsville, Ill.

**NEW JERSEY,** Camden  
Camden Lime Co.

**NEW YORK,** Buffalo 6  
Anchor Concrete Products, Inc.

**NORTH CAROLINA,** Lilesville  
W. R. Bensal Company, Inc.

**OHIO,** Akron-Cleveland  
Lake Erie Flexicore, Inc.  
PO 563, Kent, Ohio

**OHIO,** Columbus 22  
Arrowcrete Corporation

**OHIO,** Dayton 1, PO 825  
Price Brothers Company

**PENNSYLVANIA,** Monongahela  
Pittsburgh Flexicore Company

**RHODE ISLAND,** Saylesville  
Durastone Flexicore Corporation

**TEXAS,** Houston, 4511 Kyle St.  
Flexicore of Texas, Inc.

**WEST VIRGINIA,** Wheeling  
Universal Concrete Pipe Co.

**WISCONSIN,** Batalt, PO 325  
Mid-States Concrete Products Co.

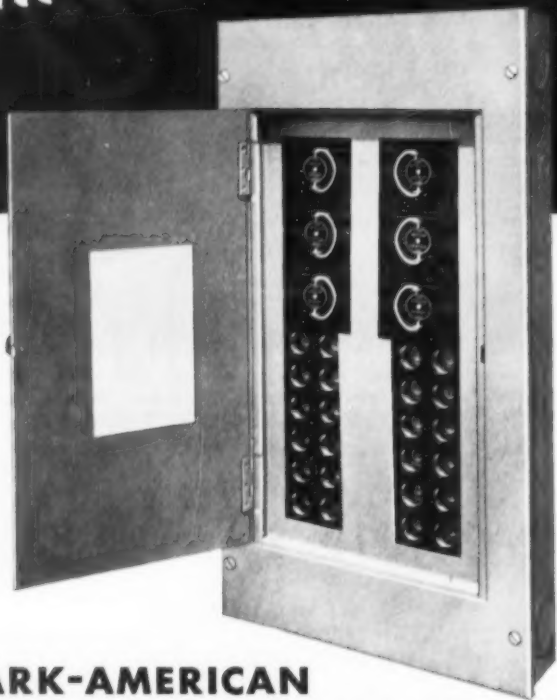
**CANADA—Toronto, Ontario**  
Murray Associates, Limited

**CANADA—Montreal, Quebec**  
Graughan & Archibald Ltd.

**CANADA, Woodstock, Ontario**  
Schell Industries Ltd.

**PUERTO RICO,** Rio Piedras  
Flexicore Co. of Puerto Rico

# NEW! for homes with electric heating



## CLARK-AMERICAN SIX PULL-OUT COMBINATION SERVICE ENTRANCE EQUIPMENT

Now you can provide all home Service Entrance facilities including heating, lighting, appliances, air-conditioning etc.—in one compact cabinet. This new unit for 120-240 volt service contains six branch pull-outs in parallel—two 60 amp. and two 30 amp. for major appliances, and two 60 amp. for controlling 24 plug fuse branches for electric heating and/or lighting. For complete information and specifications write for Bulletin 220-3.



CLARK-AMERICAN "Product Selector"  
—32 page book containing complete  
catalog—plus application and instal-  
lation data—yours for the asking.



American

ELECTRIC SWITCH DIVISION

### The CLARK CONTROLLER Company

Engineering Electrical Control • 1146 East 152nd Street • Cleveland 10, Ohio



## OPERATING 3- $\phi$ MOTORS ON 1- $\phi$ LINES

[FROM PAGE 107]

conjunction with the relay circuit may be used as a phase converter supplying other motors. Such a converter can supply power for starting and running other 3-phase motors at no load or full load.

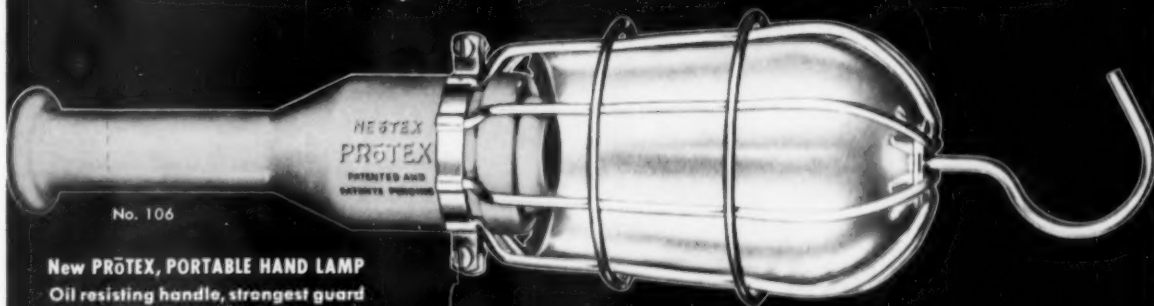
The approximate maximum electrolytic capacitance in microfarads is necessary to operate any size 3-phase motor on a single-phase line. The size of capacitor is determined from the locked rotor (motor at standstill) current of the 3-phase motor on the single-phase line. This can be obtained by connecting the motor leads No. 1 and No. 2 together and to one side of the line, with an ammeter in series with either No. 1 or No. 2 phase, and connecting No. 3 to the other side of the line—all with no capacitors or relay in the circuit. Multiply the motor standstill current (amps) in the one phase by a factor of 13 to get the required microfarad rating.

The capacitor voltage rating should be in the vicinity of 160 to 175 volts ac for 220-volt star-connected motors only. If 175-volt capacitors are not available, 110-volt or 125-volt ac capacitors can be used for applications requiring not more than five starts per hour. For this lower voltage rating, a factor of 12 is used to obtain the microfarad rating from the motor standstill current.



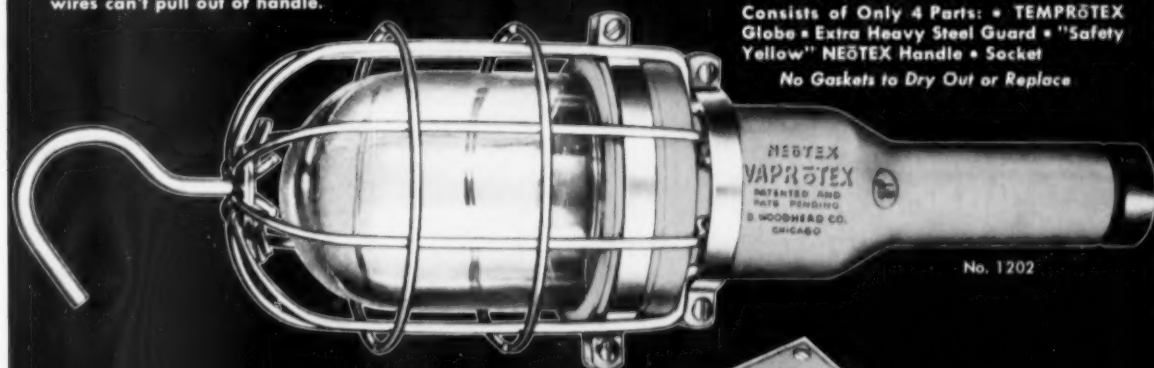
**FIELD EXPERIENCES** with electrical inspection problems in their respective jurisdictions are exchanged by (L to R): A. W. Bahrr, Madison, Wis.; and C. N. Sinnott, Kenosha, Wis. Both attended the recent Western Section, IAEI meeting in St. Louis.

# SAFETY ♦ IS OUR BUSINESS



## New PRÖTEX, PORTABLE HAND LAMP

Oil resisting handle, strongest guard on any portable (#8 steel wire). Full length light-saver reflector, taped splice for added safety... wires can't pull out of handle.



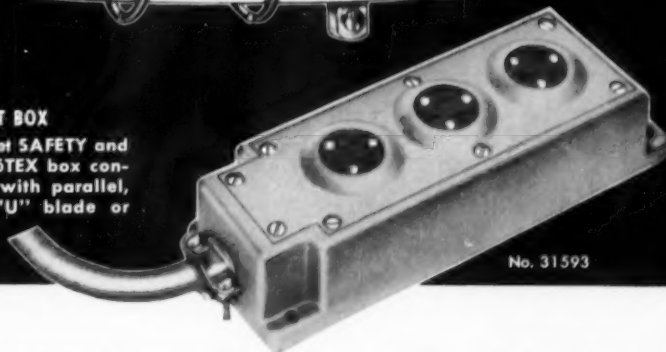
## New VAPRÖTEX, Vaporproof PORTABLE HAND LAMP

Consists of Only 4 Parts: • TEMPRÖTEX Globe • Extra Heavy Steel Guard • "Safety Yellow" NEOTEX Handle • Socket

No Gaskets to Dry Out or Replace

## New MULTI-TAP OUTLET BOX

Built for Multiple Outlet SAFETY and SERVICE with full NEOTEX box construction. Available with parallel, tandem, crowfoot, "U" blade or Turnex receptacles.



IF IT'S MADE BY  
**WOODHEAD**  
IT'S MADE FOR  
**SAFETY**

## Building New Products for Industry with "SAFETY ♦ YELLOW" NEOTEX

Daniel Woodhead's own synthetic compound...  
Impervious to oils, greases and most chemicals

WRITE US TODAY...for free Catalog giving complete product and price information



**DANIEL WOODHEAD COMPANY**  
15 N. Jefferson St. • Chicago 6, Ill.

# ✓ Totally Enclosed ✓ Class H Insulation - at no extra cost

**ALLIS-CHALMERS**

## **Dry-Type TRANSFORMERS**

**F**ORGET all about maintenance with this Allis-Chalmers totally enclosed, 150 C rise, dry-type transformer. No dirt, dust, moisture or lint can get at it. Use it indoors or outdoors. It is completely weatherproof.

Class H insulation used throughout the coil structure results in long insulation life. Case temperatures are low—do not exceed maximum of 40 C rise. All safety requirements are easily met. No vaults or barriers are needed.

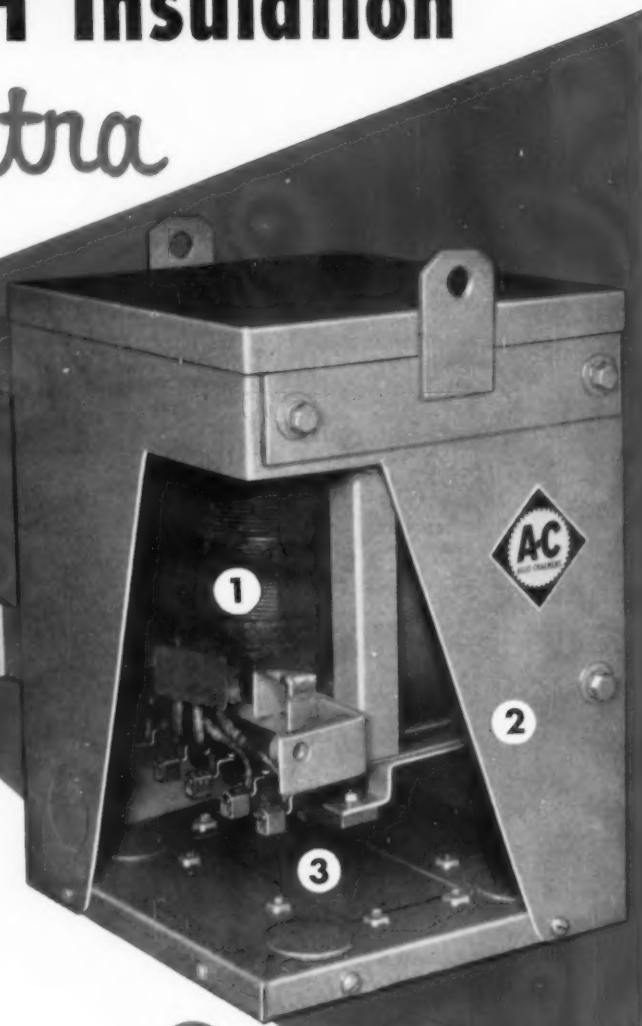
Modern design features result in a compact, convenient transformer that will give years of satisfactory operating life. All these advantages are available at no extra cost.

**For Complete Information,** call your nearby Allis-Chalmers district office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.



A-5126

# **ALLIS-CHALMERS**



**1**

Coil has maximum insulation life with Class H (150 C rise) insulating materials.

**2**

Simple, sturdy, totally enclosed weatherproof case has just one welded seam.

**3**

Recessed bottom plate has eight bolts for positive closure, yet gives quick accessibility.

# FOR MORE INFORMATION ON NEW PRODUCTS CATALOGS, BULLETINS ADVERTISEMENTS

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Use first line of boxes. Insert item numbers of products on which more information is desired.

### ● CATALOGS, BULLETINS AND ENGINEERING DATA:

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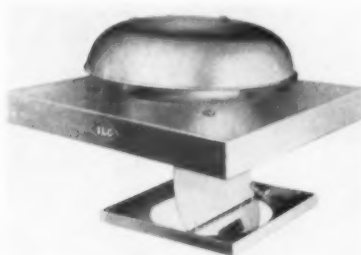
# Product News



**Flush Raceway System (1)**

A new flush raceway system, known as Flushduct, is used primarily for modernizing existing buildings. It is installed by trenching the existing floor so the ducts can be installed flush with surface of floor. Linoleum or other top surface materials are then laid directly over duct system. Ducts are furnished in 10-ft lengths, with outlets spaced every 24 in. along the duct and each outlet closed with a brass cover plate. Flushduct is available in single duct, 2-duct and 3-duct systems. The 2- and 3-duct systems are welded together. Standard Nepcoduct elbows and fittings comprise the system components. Flush-type floor junction boxes are similar in design to standard Nepcoduct boxes. Specially designed set screws hold duct firmly in place and maintain positive electrical grounding continuity. Linoleum pans are used to hold top floor covering and insure quick access to junction box hand-hole. A complete range of standard Nepcoduct service fittings equipped with standard devices are available for the flush system.

National Electric Products Corp., Gateway Center, Pittsburgh, Pa.

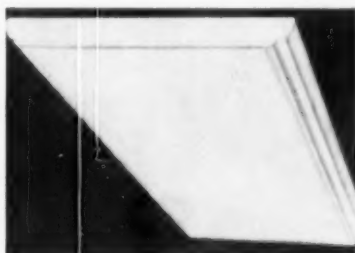


**Roof Ventilator (2)**

Three new "low silhouette" sizes have been added to this roof ventilator line. Models range in height from 6½ to 12½ in., suited to harmonize with modern institutional, commercial and industrial architectural requirements. Capacities range from 287 to 938 cfm. Motors are shaded pole type, totally enclosed, with permanently lubricated bearings. Some of the features are: unit construction;

vertical type "Q" propeller fan is mounted directly on motor shaft; electrical connections are made to outlet box on outside of housing. On the five largest sizes the permanent-split capacitor type motor has double sealed permanently lubricated ball bearings. Fan wheel is dynamically balanced. Bulletin 2300 is available.

Ilg Electric Ventilating Co., 2850 N. Pulaski Road, Chicago 41, Ill.



**Lighting Fixture (3)**

A fluorescent lighting fixture for shallow, surface mounting, called Ceilo-35. It is 2½ in. deep and is made in 2- and 4-light models. Ballasts are mounted in the sides of the fixture. Reflectors are parabolas which reflect all light straight down and provide an even distribution of light over the entire diffusing area. Installation is made easy by a removable reflector section which pulls off for hanging and wiring and snaps back into place. End medallions are taken off for continuous-row mounting. Plastic eggcrate louver is framed in metal and equipped with fingertip latches which release to allow hinged louver to swing down for relamping.

Gibson Manufacturing Co., Atlanta, Ga.

**Outlet (4)**

A weatherproof double grounding outlet to comply with the new 1956 revision of NEC, which requires all outlets that are to be used by persons in contact with ground or grounded objects to be of the grounding type. This outlet accepts the ASA and NEMA standard grounding caps as well as standard parallel caps and polarized parallel caps. It has a new type of cover plate which keeps out rain and moisture yet permits easy access to double outlet with flick of a finger. Both wall plate and cover are made of etched aluminum. Rubber gaskets above and below wall plate seal out the moisture and rain.

General Electric Co., 95 Hathaway St., Providence 7, R. I.



**Interchangeable Hub (5)**

Interchangeable raintight hubs, suitable for enclosures for safety switches, Stab-Lok circuit breakers and fusible service equipment. They have been designed to eliminate need for conduit or nipple offsets when NEMA III enclosures are used and hub requirement does not exceed 2 in. The new "Quik-Align" hubs are applied to enclosures by replacement of blank cover plate secured by 10/24 studs and nuts. They are supplied with elongated slots for accurate positioning with conduit. Reversal of hub plate permits increased forward and back adjustability. Units are available in five sizes ranging from 1-in. through 2-in. Data Sheet 1-45 is available.

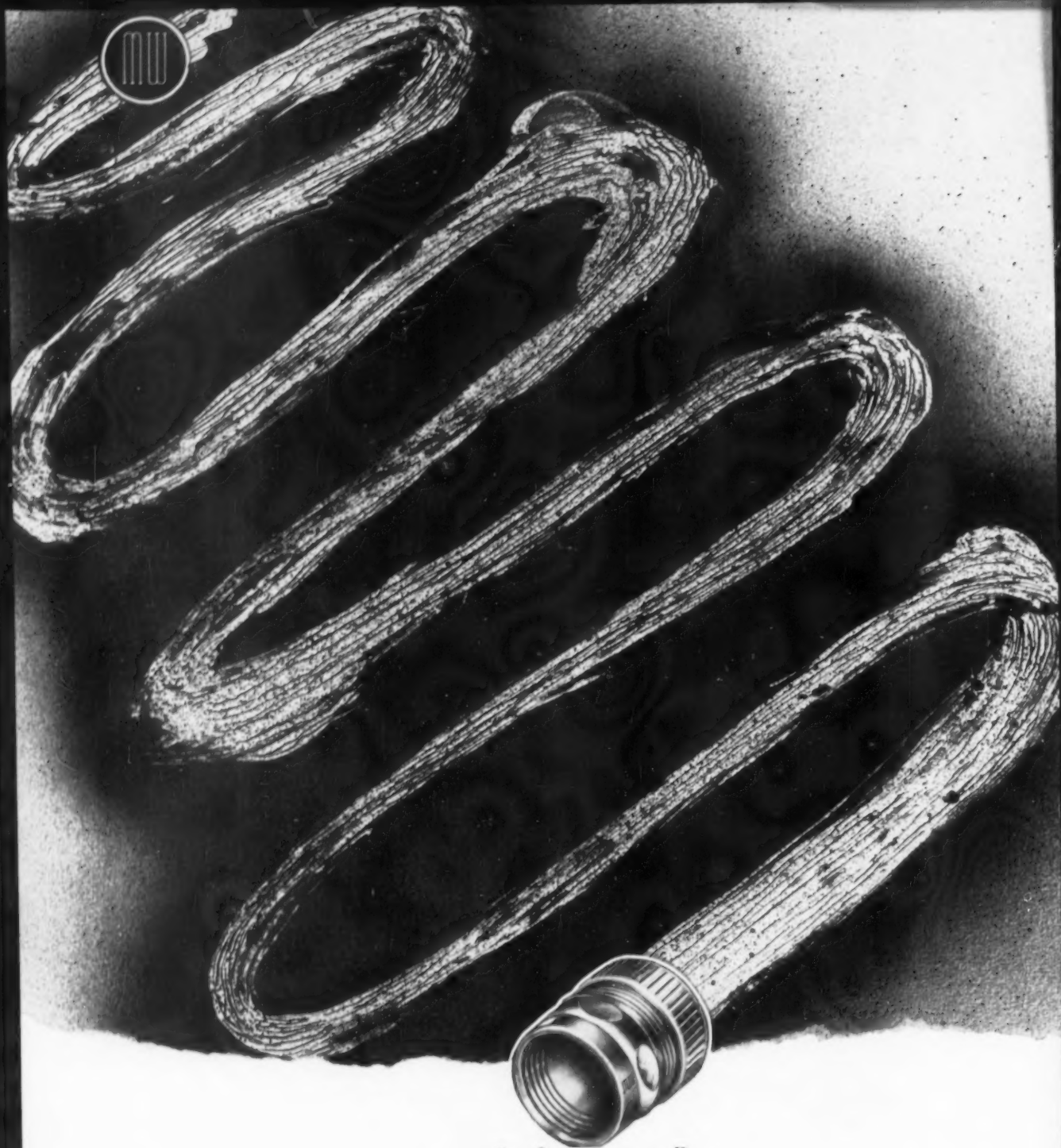
Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J.



**Recessed Troffers (6)**

Eight new models of 2 ft wide recessed troffers that install into 83 different ceiling suspension systems. Troffers feature the Gratelite louver diffuser; 1-in. cubicle facets, 45° by 45° shielding. Models are also available with Skytex and low brightness lenses. Models are available in 2- and 4-ft lengths, in 2- 3- and 4-lite units. Troffers are constructed of heavy gauge, zinc-coated and bonderized steel. All visible metal parts are finished in 300° white Permalux. Bulletin Nos. 955, 956 and 957 are available.

Edwin F. Guth Co., 2615 Washington Ave., St. Louis 3, Mo.



**midwest**

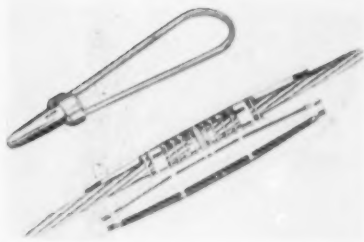
A Midwest quality fitting. "Quality" is just a condensed way of saying: "Getting the total job done right with the most inexpensive combination of material and man hours." Engineering and producing quality fittings to meet the highest standards of electrical wiring installations, is our objective at Midwest.

***Midwest Electric Mfg. Company***

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

1639 W. WALNUT STREET

Chicago 12, Illinois

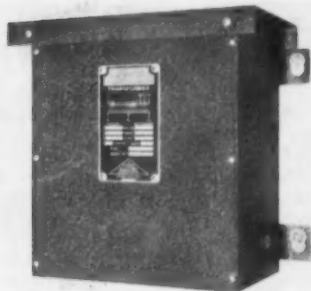


### Splices and Deadends

(7)

A new line of tension splices and deadends for use with all-aluminum conductors. Two types of aluminum tension splices have been added. One is for solid aluminum conductor and is of the standard type of design provided with release slots that permit re-sagging and re-use if desired. The other is the feed-thru "55" series tension splice. Openings at each end of splice are equipped with pilot cups. Holding power and pressure of deadends for copper conductors is evenly distributed and does not deform the conductor. The deadending unit is light enough to avoid concentrating vibration stresses.

Reliable Electric Co., 3145 Carroll Ave., Chicago 12, Ill.



### Transformers

(8)

A new line of weatherproof dry type distribution transformers especially suitable for either indoor or sheltered outdoor operation on installations where high ambient temperatures and/or high humidity exist. Class H insulation, including glass covered magnet wire, Fiberglass core washers, and silicone varnish impregnation, are employed throughout. The case measures 16 in. by 12½ in. by 9 in. Use of horizontal brackets permits resting of flat transformer base on floor, for easy installation. Four standard ½ in. keyhole type mounting holes are located on 15-in. horizontal and 11½-in. vertical centers for mounting on wall. Single phase 240/480-volt primary has four windings and 60-cycle 120/240-volt secondary has 2½ and 5% primary taps. Models in four ratings are available, 2-, 3-, 5- and 7-kva. Literature is available.

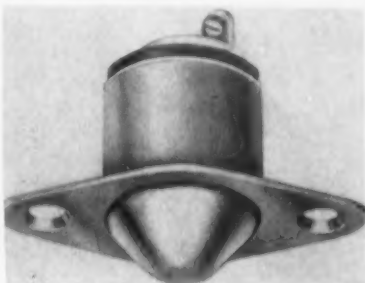
Strong Electric Corp., 160 City Park Ave., Toledo 1, Ohio.

### Support

(9)

A new "T" bar long span has been added to expanded metal trough system for the continuous protection and support of instrument tubing. It is a 3-in. by 3-in. galvanized steel "T"-shaped beam 20 ft long, slotted every 12 in. to permit bolting to bottom of the Instrof. This stiffens the Instrof and increases the maximum unsupported span length to 20 ft. "T" bars are supplied with nuts, bolt, and washers.

Instrof Corp., a division of T. J. Cope, Inc., Collegeville, Pa.



### Contactors

(10)

General purpose low voltage contactors, supplied with three make-and-break switch arrangements, that are particularly well suited for door and window alarm switches. Contactors are constructed of solid brass for mounting in unmortised ¾-in. holes. For burglar and intruder alarms they are mounted in door or window frames. They also can be used for supplementary low voltage lighting in kitchen cabinets, closets, on cellar stairs, in garages or other areas where additional lighting will provide increased safety and convenience. Contactors are supplied in three switch arrangements: No. 44, normally closed; No. 45 normally open; and No. 46 is sequenced to provide make, break and make on release.

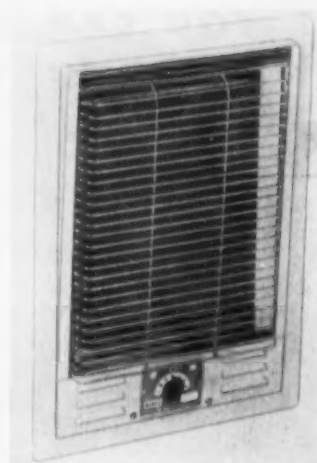
Edwards Company, Inc., 90 Connecticut Ave., Norwalk, Conn.

### Wireway

(11)

A new hinged-cover wireway, completely open for lay-in wiring, is particularly useful where space is limited and building contours are complicated. Labeled the Type HW, it has a hinged cover which opens over entire length of run to allow "lay-in" wiring through every length and fitting. It comes in 1-, 2-, 3-, 4- and 5-ft lengths and is made in three different sizes—4- by 4-in., 6- by 6-in. and 8- by 8-in. A complete line of standardized fittings is also available. A hook-and-slot arrangement permits fast assembly of sections and fittings, and lay-in feature assures speedy wiring.

General Electric's Distribution Assemblies Department, Plainville, Conn.

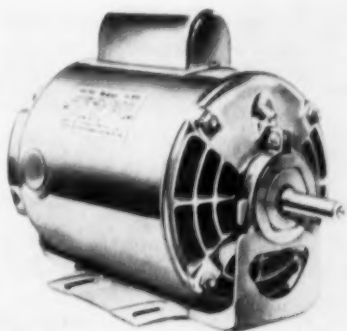


### Electric Heater

(12)

A new 750-watt unit has been added to this line of glass radiant heaters. It is one of the series of high heat output panels and is recommended for bathrooms, dressing rooms, small dens, etc. The new panel has a built-in snap action thermostat that will not cause television interference, and allows user to keep room temperature under finger-tip control. Ratings on this unit are: 750 watts; 2,560 Btu; 120 volts; 6.25 amps. Panel measures approximately 13 in. by 17 in. by 5 in.

Berko Electric Mfg. Corp., 212-40 Jamaica Ave., Queens Village 28, N. Y.



### Motors

(13)

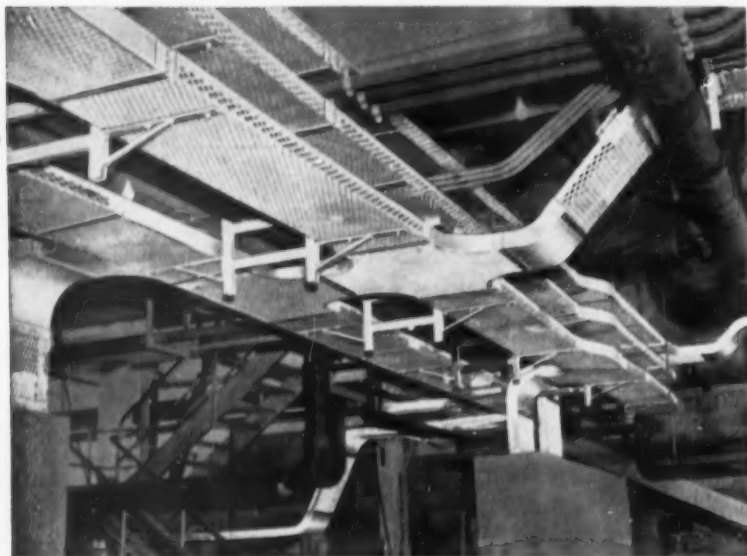
Capacitor-start and split-phase motors in rigid and resilient base models are now available in NEMA 48 frame size. Through use of smaller, lightweight, precision-machined steel frames and cast aluminum endplates, weights of ½, ¾ and 1 hp ratings have been reduced. A new lubrication system permits mounting sleeve bearing motors at any angle with positive protective lubrication in every position. Bearings, lined with high tin babbitt, have anti-seizure and non-scoring characteristics, and high corrosion resistance.

Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo.



# YOU CAN SIMPLIFY CABLE INSTALLATIONS with **COPE** CABLE TROUGH

Humboldt Bay Steam Plant Pacific Gas and Electric Company  
Engineers: Bechtel Corporation



**C**ontractors and engineers everywhere are fast realizing that more time—more costs—are saved when Cope Cable Trough is specified.

Cope Cable Trough goes up faster

Cope Cable Trough simplifies designs

Cope Cable Trough saves space

Specify Cope Cable Trough on your next job. You'll be amazed at how simple it is to install.



**Tommy Cope says:**

"Every minute you save on installation time increases your profit on the job."

Our engineers are ready to work with you. Write us today for full details on Cope Cable Supporting Systems.

## T. J. COPE, INC.

COLLEGEVILLE 5, PENNSYLVANIA



**Emergency Lighting Unit (13a)**

A new emergency lighting unit, which not only operates automatically and instantaneously during failure of normal power but also automatically prepares itself for the next blackout. Immediately following an emergency discharge, the Model A Exide Light-guard automatically recharges its storage battery at a high rate. At the end of the high-rate charge the Light-guard automatically returns the battery to a trickle-rate to maintain itself in a state of constant readiness. Standard Model A has one 25-watt sealed beam lamp, directionally adjustable, mounted on the case of the self-contained unit. One additional lamp can be mounted on the case, or two additional lamps can be connected remotely, to light adjacent areas. A total of three lamps can be powered by the unit. Designed for installation on posts or walls, the Model A is available as auxiliary lighting equipment for plug-in connection to 115-volt, 60-cycle ac power sources. Also available is a Model AE, with the same automatic features, as emergency lighting-unit equipment for permanent connection to ac power.

Department AL, Exide Industrial Division, the Electric Storage Battery Company, Box 8109, Philadelphia 1, Pa.

**Mercury Lamps (14)**

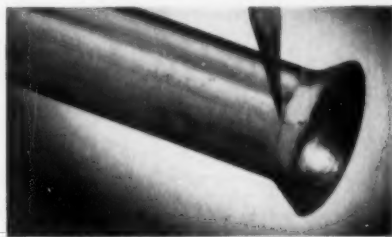
Two new 1000-watt and semi-reflector fluorescent mercury lamps which provide improved color rendition have been developed. The high output, high efficiency lamps make golden-white mercury light practical in high bay industrial lighting applications where fixtures are too small to make efficient use of the fully coated lamp. The new lamps, D-H12-WD, 220 volts and D-H15-WD, 465 volts, are coated only on the half of the lamp nearest the base. They are fully interchangeable with standard fully coated mercury lamps. Outer bulbs are made of weather duty hard glass to resist water cracks and atmospheric corrosion. Guaranteed average life of new semi reflector lamps is 7000 hours.

Westinghouse Electric Corp., Bloomfield, N. J.





**SQUEEZED** like an accordion even to the point of edge rupture . . . yet, there is no opening of the welded seam.



**FLARED** while cold during a cone test. Note the weld. There's not a single indication of a break.



**FLATTENED** like a pancake—actually creased along the weld. But, look at the weld—still unbroken, and as good as ever.



**EXPANDED** 25% and flared. If weld flaws existed, this test would find them. But look at it—still strong as ever.

## Four-way "torture" tests fail to break the weld on Rome's improved EMT

The purpose of these tests was to prove the strength of a Rome weld. But you can see by the unretouched photographs above that the weld on Rome's EMT just won't break.

In these punishing factory tests, Rome's EMT was squeezed, flared, flattened, and expanded. In each case, the weld was proved to be as strong as the metal itself.

And Rome's EMT offers you much more in addition to high weld strength. You also get these *other* important benefits:

**Easy bending.** Its strength interferes in no way with Rome EMT's uniform ductility. You can now make even intricate bends easily.

**Outstanding fishability.** The new slick mirror-smooth inside finish makes Rome's EMT easier and quicker to fish than *any other EMT* you can buy. This means you can wire up your installations much faster.

**Corrosion resistance.** A uniformly electrogalvanized exterior finish protects your installation against corrosion. Long dependable service life is assured.

This exceptionally durable and sturdy tubing exceeds all standards for thinwall raceways and has full Underwriters' approval.

**A free sample** of Rome's EMT is yours upon request. Test it and prove to yourself that Rome is your best choice for your next EMT job. Contact your nearest Rome Cable representative—or write to Department 900-B, Rome Cable Corporation, Rome, New York.

# ROME CABLE

C O R P O R A T I O N

# Rated No. 1



## THE MOST COMPLETE LINE OF QUALITY ELECTRICAL WIRING DEVICES

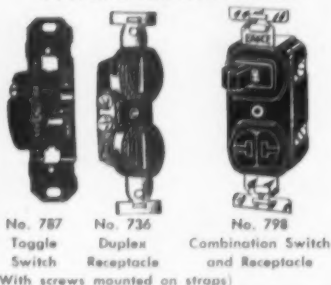
## FOR QUALITY, PRICE EASE OF INSTALLATION

The "1" Line That Offers More . . .

UP TO THE MINUTE—MODERN WIRING DEVICES FOR EFFICIENT INDUSTRIAL, COMMERCIAL AND RESIDENTIAL ELECTRICAL INSTALLATIONS

- **COMPLETENESS**—one purchase order, one shipment, one invoice, better stock control saves time and reduces handling costs.
- **LOW COST**—Eagle's 4 plants basically produce all materials, keeping costs down and allowing you a greater profit margin.
- **QUALITY**—for over 35 years Eagle has been identified as the quality wiring device line, at competitive prices. You'll eliminate service call backs because of Eagle's outstanding record of TROUBLE FREE performance.

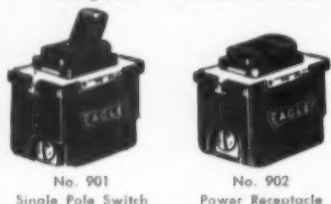
### SWITCHES and RECEPTACLES



No. 787 Toggle Switch  
No. 736 Duplex Receptacle  
No. 798 Combination Switch and Receptacle  
(With screws mounted on straps)

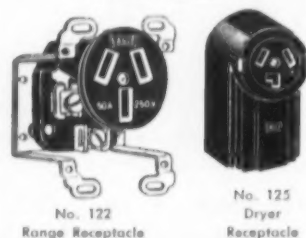
### INTERCHANGE DEVICES

Interchangeable With All Standard Lines



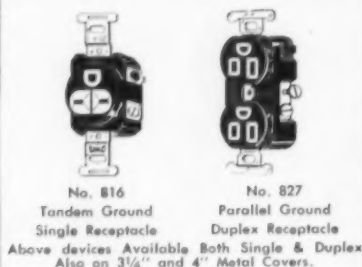
No. 901 Single Pole Switch  
No. 902 Power Receptacle

### RANGE and DRYER RECEPTACLES FLUSH & SURFACE TYPE



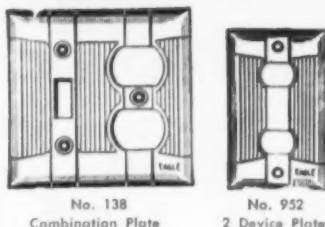
No. 122 Range Receptacle  
No. 125 Dryer Receptacle

### 3 WIRE "U" GROUND RECEPTACLES



No. 816 Tandem Ground Single Receptacle  
No. 827 Parallel Ground Duplex Receptacle  
Above devices Available Both Single & Duplex Also on 3 1/4" and 4" Metal Covers.

### EAGALINE and INTERCHANGE PLATES



No. 138 Combination Plate  
No. 952 2 Device Plate

### EAGALOK RECEPTACLES

2, 3 & 4 Wire—10 & 20 Amp



Nos. 896, 898 Nos. 897, 899 No. 890  
Nos. 897, 899, 890 Available Grounded  
All Receptacles Also on 3 1/4" & 4" Metal Covers

Illustrated above are only a few of the Eagle line of 1400 wiring devices. If you have not received your complete New 1957 catalog & price list send us the coupon below.

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Long Island City 1, New York ECM-157  
Please send me your new 1957 catalog & prices.

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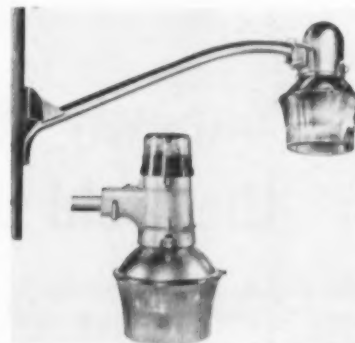
"Perfection is not an Accident"



### Terminal Block (15)

A new channel-mounted terminal block with 50% more terminals in the same space and featuring simplified assembly and modification. Blocks are 25-amp box lug type terminals. Also available in new design are 25-amp terminals with pressure wire connectors and 50-amp box lug terminals. All three types may be grouped in any manner on the same channel. A new feature is channel mounting which permits blocks to be constructed in any desired number. Channel mounting makes it possible to add new terminals to existing blocks, either at ends or in middle.

Square D Company, 4041 North Richards St., Milwaukee 12, Wis.



### Luminaire Heads (16)

Two new heads for mercury vapor or incandescent luminaires provide for a wide range of lighting requirements. One head has a top-mounted photoelectric cell to permit individual luminaire control. Both heads are available with or without internal ballasts for 3,300-lumen or 6,800-lumen mercury vapor lamps. Incandescent lamps may also be used. EEI and NEMA latching and dimensional standards have been maintained so a variety of lower optical assemblies may be accommodated. Internal ballasts for mercury vapor lamps have a rating of 100 watts at 115/230 volts or 175 watts at 115/230 volts.

Line Material Company, 700 W. Michigan St., Milwaukee 1, Wis.



*Even in moist and corrosive atmospheres...*

## Rome's multi-purpose cable meets your toughest branch circuit needs

Developed initially for the safer wiring of farm buildings—a really tough assignment—Rome FlexAll can be safely installed in practically all of your tough-duty locations. Approved for direct-in-earth burial, FlexAll is perfect



**PACKAGED FOR CONVENIENT USE.** Rome's multi-purpose FlexAll is packed in 250-foot cartons for easy storage and use.

for outdoor lighting applications—residential, rural, industrial, and commercial. And it's ideal for locations where moist and corrosive atmospheres prevail: for food processing plants, dairies, breweries, packing houses, cold storage and ice plants, etc.

The tough Rome Synthanol (polyvinyl chloride) jacket protects the cable against air containing salt, smoke, or humidity. And it's resistant to corrosion, abrasion, and even flame. It assures safety, easy handling and long cable life. Select Rome FlexAll for your toughest branch circuit applications.

The National Electrical Code recognizes Rome FlexAll for all these uses:

### **Single Conductor, Type UF**

- For branch or feeder circuits buried directly in earth, when provided with overcurrent protection.

### **Multiple Conductor, Type UF and NMC**

- For branch or feeder circuits buried directly in earth, when provided with overcurrent protection.
- For interior wiring, either exposed or concealed, in dry, wet or corrosive locations.
- For installation within hollow spaces of outside or inside masonry block or tile walls.
- For embedding in plaster or shallow chase in masonry, when suitably protected.

Contact your nearest Rome Cable representative for further information—or write to Department 344 and ask for Bulletin UF-1. Rome Cable Corporation, Rome, New York.

# ROME CABLE

C O R P O R A T I O N

ON ANY  
WIRING  
JOB...  
THE COST OF  
CONNECTORS  
IS "PEANUTS"!

Why Take Chances Here?  
**BE SURE** with



The cost of wire connectors is only a tiny part of the total cost of the job. Yet the whole system is literally held together by the connectors. They are as critical to it as the mainspring is to a watch. The best is always the cheapest.

IDEAL "Wire-Nut" Connectors have been setting quality and dependability records for over 30 years. Many of the original "Wire-Nut" Connectors are still in service... as good as the day they were installed!



#### FULLY APPROVED!

(UL) Contractor sizes 74B and 76B are fully approved as pressure cable connectors for general use in all types of branch circuit wiring, with all common wire combinations.

Sold through America's Leading Distributors.  
In Canada: Irving Smith, Ltd., Montreal

**TRY THEM FREE!**

IDEAL INDUSTRIES, INC.  
1041 Park Avenue, Sycamore, Illinois

Please send FREE SAMPLES of IDEAL "WIRE-NUTS"

Name \_\_\_\_\_

Company \_\_\_\_\_

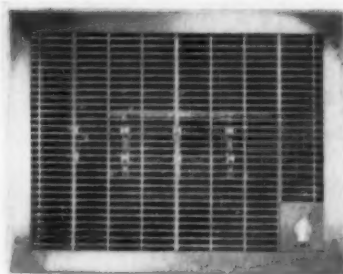
Address \_\_\_\_\_

City \_\_\_\_\_

Zone \_\_\_\_\_ State \_\_\_\_\_



**IDEAL**



#### Electric Heaters

(17)

A full line of wall-type electric heaters, known as Ray-Vec heaters, have been engineered to supply instant heat at low cost for bathrooms, kitchens and other small rooms. The heating element consists of Nichrome resistance wire mounted in heavy-duty rust-resistant frame. The high-gloss chrome reflector provides radiation and natural convection. Both manual and thermostat controlled models are available. Designed for installation in existing or new construction, Ray-Vec fits between wall studding 16 in. on center.

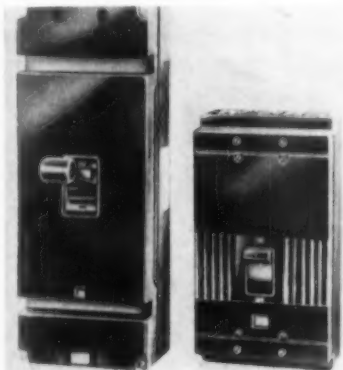
*Electrend Products Corp., State and Water Sts., St. Joseph, Mich.*

#### Lamp

(18)

A new "Cool-Light" lamp is available in 40-, 60-, 75- and 100-watt sizes, as well as in 50/150-watt 3-way lamps. The aqua-tinted "Cool-Light" complements the cool colors on the low side of the color spectrum—blue and green—whereas the pearl-pink "Softlight" complements the warm colors on the high side of the spectrum—reds, oranges and yellows.

*Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.*



#### Circuit Breaker

(19)

A new 800-amp molded case circuit breaker, designated the KM-frame, covers applications now using M, L (left) and KL sizes. One frame size can be used for all ratings from 125



through 800 amps. Savings in space up to 30% for each breaker are possible in ratings above 400 amps. Breakers are available in 2- and 3-pole designs. The 2-pole units are rated 125 to 800 amps, 600 volts ac; and 125 to 600 amps, 250 volts dc. The 3-pole units are available in ratings of 125 to 800 amps, 600 volts ac. Interrupting ratings are 50,000 amps rms asymmetrical at 240 volts ac; 35,000 amps at 480 volts ac; 25,000 amps at 600 volts ac; and 20,000 amps at 250 volts dc. The KM breaker is Underwriters' Laboratory listed through 600 amps. The 700- and 800-amp ratings are being tested now.

General Electric Co., Circuit Protective Devices Department, Plainville, Conn.



#### Underfloor Duct Systems (20)

Large capacity combination underfloor duct systems for telephone and other low-tension service. Junction boxes are designed to accommodate No. 4 duct (8.75 sq. in. cross-section) and No. 2 duct (3.31 sq. in. cross-section) and are available for the following combination duct systems: One No. 2 and one No. 4 duct; One No. 4 and two No. 2 ducts; One No. 2 and two No. 4 ducts. Junction boxes are designed with a straight passageway for easier pulling of telephone cables up to 100-pair size. Boxes feature easy and precise levelling to screed line.

Walker Brothers, Conshohocken, Pa.



#### Heat and Light Unit (21)

"Solar Glass" Heat-N-Lite unit is for installation in the bathroom. It warms surfaces, objects, and bodies, without heating the air directly, and it provides 150 watts of indirect lighting. Unit is controlled automatically by thermostat, independent of the rest of the house.

Electricglas Corp., Bergenfield, N. J.



Takes  
the  
**"UGH"**  
**TOUGH**  
out of  
wire pulling jobs



**WIRE  
LUBE**

- Makes Wire Pulling Easier, Gets the Job Done Faster
- Protects Insulation Against Breaks and Strains
- Use it on Rubber, Lead or Plastic Covered Wire or Cable
- Available in pint, quart, 1-gallon, 5-gallon and 55-gallon Containers, Also in Handy Tubes

"Wire Lube" is a special formula lubricant that makes the toughest, muscle-straining wire pulling jobs quick, simple, easy. The liquid lubricant can be hand or brush applied to wire or cable as it is pulled into the conduit. Wires and cable "rides" in on a film of lubricant which quickly dries to a fine white powder. No sticky sludge forms to bond wire and conduit; in fact, the powder makes the removal of wires much easier. Wire Lube is non-corrosive, non-combustible and can't injure hands or clothing. Order today for easier wire pulling jobs tomorrow.

#### Also Available in New Tube Packages

Handy, individually packed tubes of Wire Lube are ideal additions to the electricians tool box. Each tube contains just enough Wire Lube for the average small job. Look for the attractive display carton on your Distributor's sales counter.

Mail Coupon For Catalog Details



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1041 Park Avenue, Sycamore, Illinois

Please send catalog on Ideal "Wire Lube"

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Canadian Distributor IRVING SMITH, LTD., Montreal

SOLD THROUGH

**IDEAL**

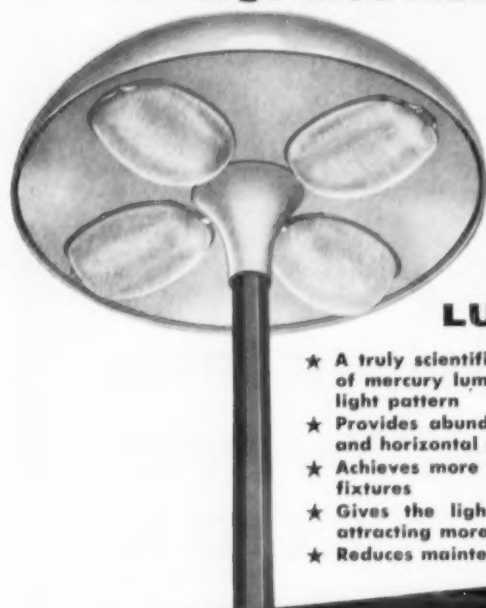
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with Fewer Poles!

New **Revere** "4 in 1 Spectacular"  
for large area illumination



## Important Advantages of the **"Ultra-Lite"** LUMINAIRE...

- ★ A truly scientific and effective application of mercury luminaires producing a square light pattern
- ★ Provides abundant light for both vertical and horizontal surfaces
- ★ Achieves more light with fewer poles and fixtures
- ★ Gives the lighted area new impetus in attracting more trade
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TYPICAL INSTALLATION

Mounts on Revere 30 foot  
Octagonal Rigid Poles or  
Revere No. 199-D830  
Hinged Pole. The Hinged  
Pole permits easy cleaning  
and maintenance  
without expensive  
elevator equipment.

Revere Ultra-Lites with their 52 inch spherical dome and four Mercury Luminaires offer an entirely new concept for large area lighting. They provide wider coverage, better vision and high efficiency coupled with a modern, distinctive appearance which makes them the most logical units for lighting of Shopping Centers and Parking Lots—Play Grounds—Amusement Centers—Beaches—Drive-ins, etc.

Write today for descriptive literature.

REVERE ELECTRIC MFG. CO. • 6009-17 BROADWAY • CHICAGO 40, ILL.  
Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto, Ontario

THE ONLY COMPLETE LINE OF LUMINAIRES • FLOODLIGHTS AND POLES FOR STREET • SPORTS  
AIRPORT • SERVICE STATION • OUTDOOR THEATRE • MARINE AND INDUSTRIAL LIGHTING



### Brakemotors

(22)

A new line of cast-iron brakemotors that stop instantly and hold heavy loads. Features include a wide torque range from 3 lb-ft to 345 lb-ft, one-piece molded friction linings for quick stops, and one-operation torque setting. In event of power failure or low voltage, "dead man" operation sets and holds the load until normal operation is restored. All types of enclosures are available including those suitable for outdoor installation or where moist, corrosive, or abrasive dust conditions exist. Standard enclosures include protected, totally enclosed, non-ventilated, totally enclosed, fan-cooled, and explosion-proof Class I, Group D and Class II, Groups E, F, and G.

Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland 10, Ohio.



### Portable Heater

(23)

A new radiant glass portable heater designed for use in any size or type room—home, office, or factory. It is rated at 1320 watts, 4266 Btu and operates on 120 volts, ac. It has a precision thermostat that does not interfere with TV or any other electrical service and permits finger-tip control of room temperature. Control dial is located at top of heater. Casing is all metal. Legs have "no-mar" tips. It measures 24 in. high by 22 in. long by 4½ in. deep and has an indicating light that shows when unit is operating. Approved by Underwriters' Laboratories.

Berko Electric Mfg. Corp., 212-40 Jamaica Ave., Queens Village 28, N. Y.

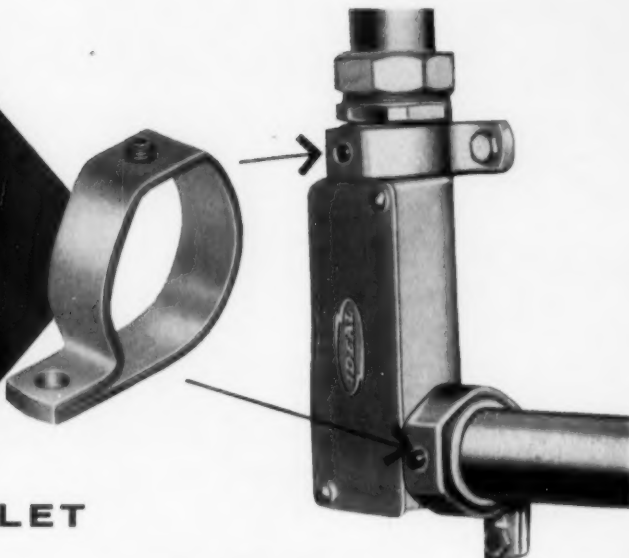
# New

## fast way to hold fittings in place



SIMPLET

# HUB-LUGS



- REPLACE WELD-ON LUGS
- NO WAITING — ORDER WITH FITTINGS

- MEET J. I. C. AND N. M. T. B. A. RECOMMENDATIONS
- LOW COST — EASY-TO-USE

### IDEAL-SIMPLET FITTINGS INCLUDE...



RECTANGULAR  
SIMPLETS L, LB,  
C, T, LL, LR, LRL,  
ETC.



FE AND FD  
SIMPLETS



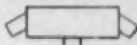
VAPORTIGHT  
FITTINGS  
VU, VO, VW



HANGING  
DEVICES  
ALC, ETC.



ROUND  
SIMPLETS G,  
GRF, GRLF, H,  
SE, OS, OSL,  
ETC.



WEATHERPROOF  
SIMPLETS  
A AND B TYPES

AND MANY OTHERS—FOR COMPLETE CATALOG,  
SEE YOUR WHOLESALE, OR SEND COUPON...

The latest development by Ideal-Simplet  
for the benefit of contractors everywhere!

Made to fit the sizes of Ideal-Simplet Rectangular Fittings only, Hub-Lugs (patent applied for) provide low-cost mounting of fittings in wiring systems for industrial and commercial building. Use in place of costly welded-on lugs. Perfect for machinery when applying fittings in electrical control or operating systems. The only *safe* application method that provides a moisture-proof, strong, rigid, durable mounting of fittings!

### BY THE MAKERS OF THE FITTINGS

### WITH THESE OUTSTANDING FEATURES

- Fastest delivery in the industry
- U. I. Approved
- Strong, rugged, durable
- More work area inside
- Screws in corners—no obstructions
- Ground surfaces for tighter seal
- Field service help
- Covers packed with LB, C, E, T, LL, LR, LRL rectangular fittings, if you prefer

### ORDER IDEAL-SIMPLET HUB-LUGS AND

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Pioneers in Conduit Fittings  
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Send complete Hub-Lug data and prices ☐ New catalog ☐

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*This is the year G-E breaks through the size barrier in circuit breakers*



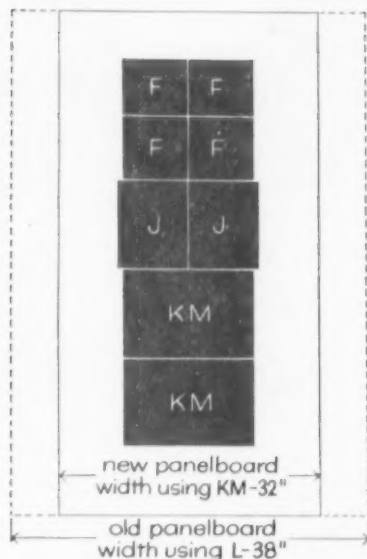
**INTERRUPTING RATING—Same NEMA ratings as L frame**

Voltages	240 a-c	480 a-c	600 a-c	250 d-c
Amperes (RMS Asymmetrical)	50,000	35,000	25,000	20,000

**RATINGS**

POLES	AMPS	VOLTS
3	125-800	600 a-c
2	125-600	600 a-c, 250 d-c
	700-800	600 a-c

# New 800-ampere circuit breaker needs 30% less space, cuts equipment size



*In panelboard designs, you can save over six inches in width by using the KM instead of the L frame. Similar savings in valuable floor or wall space can be realized in your equipment by using the new KM circuit breaker.*

**New KM breaker simplifies inventory problems. You can standardize on one compact frame size instead of three for all ratings from 125 to 800 amperes**

Equipment such as panelboards, switchboards and motor control centers can now be reduced in size. General Electric's new KM-frame molded case circuit breaker is 30 percent shorter than the L-frame size, and requires no more mounting area than the K frame. This new KM breaker has full L-frame interrupting ability in ratings from 125 to 800 amperes.

**Smaller investments in inventory mean extra savings for you**

General Electric offers you more than space savings with the KM breaker. Inventory is reduced. You no longer need to stock the KL, L and M circuit breakers. Stock only the KM frame, a supply of interchangeable trip units, three lug sizes and standardized hardware for mounting. You tie up less money in inventory because fewer parts are needed.

Enclosures and accessories are available to fit your needs. The KM is UL listed. Ask your G-E Representative to give you the full story now! For more information write for Bulletin GED-3055 from Section 22, Circuit Protective Devices Department, General Electric Company, Plainville, Connecticut.



**The only full line of molded case circuit breakers proved at the world's largest high power testing laboratory**

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

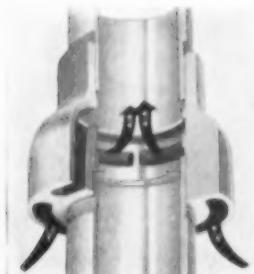
less  
**HEAT**  
more  
**LOAD**



FOR CABLE IN CONDUIT...WITH

# PLM

## CONDUIT VENTILATING CABLE SUPPORTS

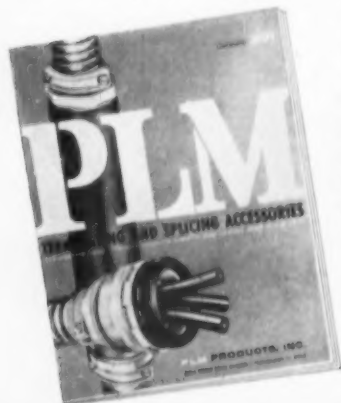


Type BCV Conduit Ventilator provides air intake at base of conduit riser. May also be used at base of vertical splice between cable in conduit and armored cable, with PLM Splice Kit.

● Don't let bottled-up heat limit the load capacity and service life of cable in conduit! PLM Conduit Ventilating Cable Supports provide cooling air circulation...permit heated air to escape from cable risers in conduit where heat tends to build up. Water-tight seal keeps water out.

Ventilating supports for top of riser supplied in types for new or existing installations, with or without flanges to support potheads. Write for full details, as well as information on PLM armored cable fittings, terminating and splicing kits, contained in PLM Catalog 301.

NEW PLM CATALOG 301 includes dimensions and shipping weights, as well as prices, for planning cable installations. Fittings are listed in both cast aluminum and bronze.



**PLM PRODUCTS, INC. • 3875 West 150th Street • Cleveland 11, Ohio**  
WIRE AND CABLE FITTINGS AND ACCESSORIES



**Lighting Fixtures (24)**

New lighting fixtures for residential and commercial service are available in 15 models. They are available in black, brass, copper, and aluminum. Included are single, double and triple indoor hanging units with matching indoor and outdoor wall fixtures. Hanging units are supported by white drop cords which can be varied in length. Also available are two new flush ceiling fixtures. One type finished in brass, copper or aluminum utilizes a 150-watt lamp and comes in 6-in., 8-in., and 10-in. diameters. The other, a chrome finish, uses three 60-watt lamps and is 12½ in. in diameter. Three types of spotlight units include a permanent and both single and double adjustable swivel units. All use either R-40 or 150-watt lamps.

John C. Virden Company, 6103 Longfellow Ave., Cleveland 3, Ohio.



**Portable Heaters (25)**

A complete line of portable heaters feature "Delta Cone" design which increases radiation through the angular shape of the cone itself and the cone position in relation to the reflector. As in the wall insert heaters, the close-tolerance thermostat is located directly in the incoming cold air path, enabling it to measure room temperature exactly. The 240-volt portable heaters are available in 2000, 3000, 4000 and 4800 watts with the 208-volt units available in 2000, 3000 or 4000 watts. Handle is located on rear panel and never becomes heated.

Ceilheat, Inc., 5212 Homberg Drive, Knoxville, Tenn.



# "We back every Spang Conduit installation we make with a One-Year Unconditional Guarantee!"

says *Mr. R. C. Jackson*  
*Cahn Electric Co.*  
*Shreveport, Louisiana*



Billy E. Arnold unloads conduit which has been stored outside for several months. HD galvanized finish is highly resistant to corrosion, despite exposure to elements.

"That shows our confidence in SPANG Conduit. Of course, we expect it to last a lifetime. A *top-quality* conduit like SPANG means longer service life, fewer rejections, less installation time and more satisfied customers. That's why we use SPANG on 90% of our installations, and on many of our larger jobs requiring a carload or more we use it exclusively."

## The new Shumpert Hospital installation

Cahn Electric has installed over 70,000 ft of SPANG HD Galvanized Conduit at

the new Shumpert Hospital, Shreveport, Louisiana. This \$10-million, 300-bed hospital will be completely furnished with the latest electrical equipment from an audio-visual nurses' call system to closed circuit TV in the cobalt treatment room . . . from the emergency power system to iron lungs. SPANG HD will give the hospital *top-quality* service.

"We were low bidder of six on the project," reports Mr. Jackson. We saved money by ordering SPANG Conduit in carload lots and storing it on location. The conduit was exposed to all the elements, but when we were ready to use the conduit several months later, we found it in excellent condition! Wire pulling was easy as ever, and no rejects!"

## Let SPANG guard your reputation, too!

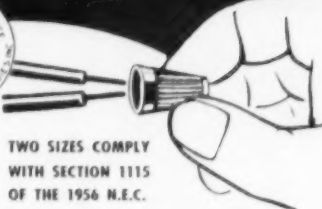
SPANG HD Conduit is easy to bend, thread and cut . . . is highly resistant to corrosion . . . offers years of *top-quality* service in any installation. Make SPANG HD your first choice every time. Your local SPANG Distributor is at your service.



"Our fine reputation is our best advertisement," says Cahn Electric's R. C. Jackson. "And SPANG helps us maintain it." Cahn Electric has installed over 70,000 ft of SPANG HD Conduit in the New Shumpert Hospital, Shreveport, La., scheduled to open in mid-1957.

PLAY  
IT SAFE...  
buy  
"Hi"!

# Hi "Screw-on" WIRE CONNECTORS NOW APPROVED FOR 600 VOLT USE!



TWO SIZES COMPLY  
WITH SECTION 1115  
OF THE 1956 N.E.C.

Take advantage of the cost saving features of "Hi" precision made connectors on ALL wiring jobs. Cat. Nos. Hi-4 and Hi-6 Bakelite Connectors NOW U.L. approved as pressure cable connectors for general use in all Branch Circuit and Fixture Wiring. FAST, EASY TO USE!

## "Hi" Quality Costs No More!

### HI PLASTIC ANCHORS

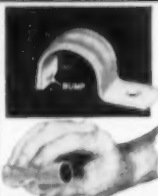


#### THE MODERN ANCHOR FOR SCREWS OR NAILS

Cut Anchoring Costs Up To 70%! Tremendous holding power... "Use in any material you can drill"—concrete, cinder block, tile, brick, mortar, metal, etc. Sizes for No. 4 screw to 1/2" lag screw... Buy 'em by the Carton or in handy Plastic Kits.

LOW COST • LIFE-TIME ANCHOR!

### HI "SNAP-ON" STRAPS



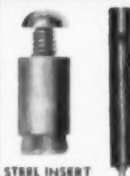
**TIMESAVERS**... Just "snap-on"—they hold tight leaving both hands free for installing rigid or thinwall conduit... Makes difficult and conventional installations easier. Precision made of heavy gauge steel, zinc coated. Sizes 3/8" to 2".

### HI "TAPE-MATE" FISH TAPE WINDER



IT'S NEW! Attaches To Fish Tape Reel... protects your hands... slides around reel. Push to wind... pull to pay out tape. Eliminates kinks and broken tape.

### HI LEAD EXPANSION ANCHORS



#### for MACHINE SCREWS

Insert is made of copper coated steel... Stronger, gives greater holding power than die cast inserts used in ordinary anchors. Spring action setting tool, FREE! Sizes, 6-32 to 3/4-10.

STEEL INSERT  
SPRING ACTION

### HI TOGGLE BOLTS



MUSHROOM STYLE HEAD, available 7 popular sizes. Prevents head from going through bolt hole... eliminates need for washers. Complete line of "Hi" quality "Spring-Wing" and "Tumble" Toggles. Screws accurately machined... milled slots. All screws and heads plated.

### "HI-TWIST" MASONRY DRILL



#### Tipped with CARBOLOY

Pays for itself in just a few holes! Drills faster... cleaner, without burning. Improved design prevents packing or stalling... stays sharp longer. Costs no more than ordinary carbide drills... Sizes 1/4" to 1 1/2".

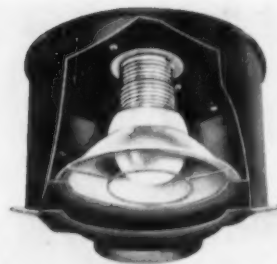
MAIL COUPON  
FOR 1957  
"Hi" CATALOG



NAME \_\_\_\_\_  
FIRM \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_

**HOLUB INDUSTRIES, Inc.**

442 ELM STREET • SYCAMORE, ILLINOIS

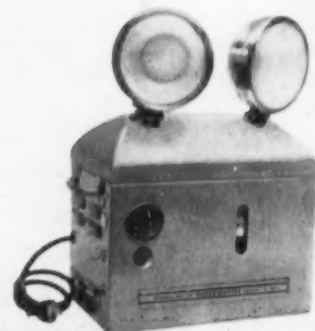


### Spotlight

(26)

An almost invisible source of decorative gold, red, blue, or "complexion pink" light is provided by a colored aluminum spotlight reflector. Reflector is made for the Vari-Spot recessed adjustable downlight. Used with a silvered-bowl 100-watt white lamp, it casts soft illumination. Recommended installations include accent lighting in restaurants, theaters, lounges, window displays, banks, offices, etc. A colored anodizing process is used to give the aluminum reflector a transparent coating. White light from bulb is reflected back as color of coating, while silvered bowl prevents direct white light from reaching area illuminated.

Curtis Lighting, Inc., 6135 W. 65th St., Chicago, 30, Ill.



### Emergency Light

(27)

A new unit in the "Watchmaster" series of automatic emergency lights features exclusive, floodlight type, sealed-beam lampheads with strong center beam to light long passageways or to pinpoint exits and critical controls. Unit has, in addition, a device that almost totally prevents the loss of water from the batteries by trapping and re-converting into water the hydrogen and oxygen given off in charging. A timing mechanism guards against overcharging of the battery on "high charge". Units plug into standard outlets and will automatically light up when current fails and other lights go out.

Automatalite Division of Carpenter Mfg. Co., Bradley St., Somerville 45, Mass.

# APPLETON'S

## new<sup>®</sup>

# expandable Bar Hangers and Bar Sets



patent applied for

### 3 EXCLUSIVE FEATURES

Concealed "nail" prongs eliminate possibility of injury . . . grab studding quickly . . . hold firmly until you finally position box!

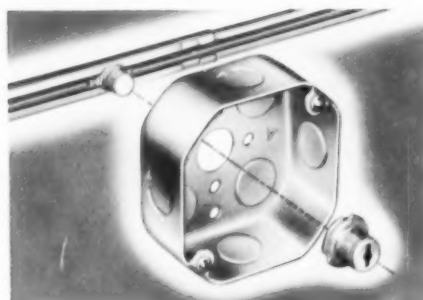
Positive 2-piece stud. Box stud engages bar stud in seconds . . . more wiring room!

Center safety-lock designed to hold arms together even if subjected to stresses beyond U/L requirements!

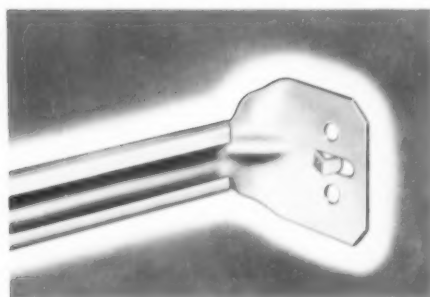
See  
Other  
Side

# APPLETON Expandable Bar Hangers and Bar Sets are Quality Engineered for Lasting Performance!

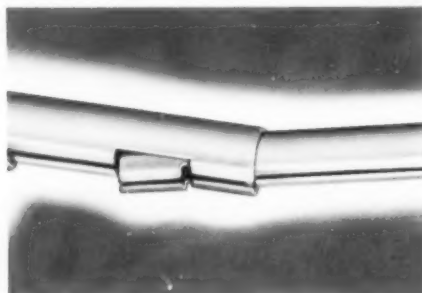
■ 2 models fit space between joists for studding!  
All parts are tough, heavy gauge steel for maximum application life. The simple 2-piece stud gives you even more wiring room and all units meet or exceed U/L requirements. From any angle, the cost and time saving features built into this new APPLETON Bar Hanger and Bar Set make them an outstanding buy... Another example of APPLETON's continuing program of market research to give you the finest and most efficient products in the electrical field.



See the amazingly simple and yet super-tight method of fastening the outlet box to the bar hanger with the New APPLETON 2-piece Hanger Stud! Simply slip the bar stud through box knockout and engage box stud. Two quick steps that mean no more fumbling during awkward ceiling work. Another exclusive feature to save time and money!



This enlargement shows the actual construction of the metal positioning "nail" concealed on the ends of all APPLETON Expandable Bar Hangers. These sturdy metal prongs bite into the studding with a light hammer blow... giving temporary support until the bar hanger is fixed into permanent position with regular nails. Because these prongs are concealed, cuts and annoying scratches are reduced to a minimum. This exclusive APPLETON feature saves time and reduces installation costs!



An extra safety feature exclusive with the APPLETON Bar Hanger and Bar Sets is shown in this enlarged photo. A sturdy hook type flange prevents the 2 metal arms of the APPLETON Expandable Bar Hanger from pulling apart under pressure exceeding U/L requirements. Think of the convenience in overhead installation.

## EXPANDABLE BAR HANGERS

Catalog Number	Length Of Hanger		Used Between Joists Which Are On Centers Of:	Std. Pkge.	Wt. Per 100
	Min.	Max.			
SX-115	11 1/2"	18 1/2"	14"-16"-18"-20"	50	41 lbs.
SX-160	16"	26 1/2"	18"-20"-22"-24"-26"	50	52 lbs.

## EXPANDABLE BAR SETS

Catalog Number	Catalog Numbers Used To Make Bar Sets		Used Between Joists Which Are On Centers Of:	Std. Pkge.	Wt. Per 100
	BOX	BAR			
SX-115-40 1/2	40 1/2	SX-115	14"-16"-18"-20"	25	93 lbs.
SX-115-560L	560L	SX-115		25	95 lbs.
SX-115-561L	561L	SX-115		25	102 lbs.
SX-115-551L	551L	SX-115		25	111 lbs.

Sold Exclusively Through Selected Wholesalers



**APPLETON ELECTRIC COMPANY**  
1717 Wellington Avenue • Chicago 13, Ill.

*Today, More Than Ever...*

**"APPLETON ... the Standard for Better Wiring"®**

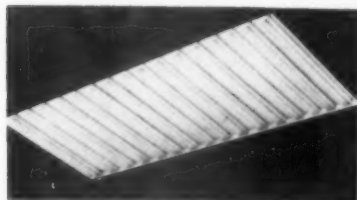




## High-Voltage Starter (28)

A new line of NEMA Class E-1 high-voltage air-break starters with an interrupting capacity of 50 MVA. A contactor has replaced current-limiting fuses to provide interrupting capacity in the new line. Starter may be easily converted to provide a maximum interrupting capacity of 150 MVA at 2300 volts and 250 MVA at 4000 or 4600 volts. The line can be applied in any plant where a high-voltage starter is needed and the available power supply is limited to 50 MVA or less. For use on utilization voltages of 2300 to 4600 volts, the new starter incorporates features of G-E Limitamp controllers. It is entirely front-connected, requires a minimum amount of floor space, has a roll-out contactor, gang-operated disconnect switch, and a maximum rating of approximately 3000 hp at 4600 volts.

General Electric Co., Schenectady 5, N. Y.



## Fluorescent Lighting (29)

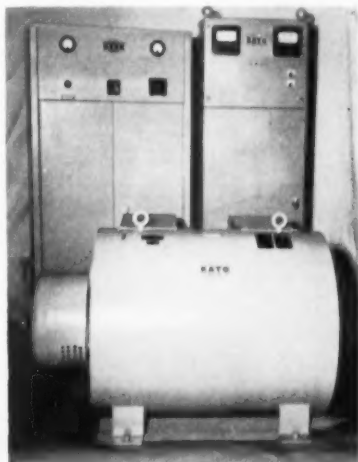
A new recessed fluorescent lighting form specially designed for use with almost all of the new types of 2-ft by 4-ft acoustical ceilings, as well as plaster ceilings. Called Strialux, the new architectural fixture provides fully-luminous, wide-area, modular panels of light which blend cleanly into the ceiling design. Strialux was primarily designed for suspended acoustical ceilings where it becomes a part of the ceiling. Flange models will fit plaster ceilings as well. Strialux modules may be used individually or in continuous runs of light, and are effective as abstract or checker-board arrangements. Unit is intended for commercial applications.

Lightolier, Inc., 346 Claremont Ave., Jersey City 5, N. J.

## Industrial TV Control System (30)

A "single-cable" industrial television control system, which combines both visual observation and remote control throughout a plant over a closed-circuit television system, has been introduced. Feature of this system is its ability to carry all functions—two-way pictures, two-way communications, remote control—over a single coaxial cable. Previously, a separate cable had been required to carry each of these functions. System permits the use of virtually any closed-circuit television camera. Cameras of different manufacture can be mixed in the same system and plugged in at any point. While featuring multiple inputs, it also offers an unlimited number of outputs to commercially available television receivers.

Jerrold Electronics Corp., 23rd and Chestnut Sts., Philadelphia 3, Pa.



## Synchronous M-G Set (31)

A frequency-changing synchronous motor-generator set, changes 60-cycle ac to 400-cycle ac. Motor and alternator are incased within a common frame with a single shaft, two ball bearing construction. Static excitation for alternator is incorporated within the alternator control cubical (at left) together with magnetic amplifier voltage regulator, volt-amp meter selector switch, volt meter, amp meter and rheostat. Cubical at right is a magnetic reduced voltage synchronous motor starter incorporating dc and ac ammeter, start-stop button, overvoltage protection and necessary component parts such as transformers and relays. The 60-cycle motor is 75 hp. Motor exciter is 1500 watts. The 400-cycle generator is 50 kw at 80% power factor and 62.5 kva. Voltage selection is 120/208. The primary source of supply of direct current to excite the field coils of alternator is obtained from 60-cycle input line.

Kato Engineering Co., Mankato, Minn.

On ungrounded 440 v. 3-phase systems  
**THIS  
ELECTRONIC DEVICE  
gives you audio-visual..**

# WARNING

**... before those  
hidden grounds become  
dangerous and costly!**

By warning of trouble before it becomes serious, the DELTA-DESCO GROUND ALERT saves in many ways. Saves expensive motor rewinds. Protects switch gear and transformers. Prevents crippling shutdowns. Reduces the possibility of fire hazards and personnel injury.

HOW IT WORKS! RED light flashes on and BELL rings when ground develops in any phase. Only GREEN light burns when phases are ground-free.

Simple, trouble-free. Easy to install. Portable or stationary models.

**WRITE FOR DESCRIPTIVE BOOKLET  
—TODAY!**

DELTA-DESCO COMPANIES  
**DELTA ENGINEERING SALES CO.**  
539 Aero Drive  
Shreveport, Louisiana



For any  
440 v.  
3-phase  
ungrounded  
system

## DELTA-DESCO Electronic GROUND ALERT



# Get the Facts on **TOLEDO** **PORTABLE POWER** **DRIVES**



**TOLEDO No. 78**  
Power Drive—with  
wrenchless chuck,  
forward or reverse  
rotation, 1/4"  
to 2" capacity—  
a real work saver!



**TOLEDO No. 68**  
Power Drive—threads,  
cranks, turns, pulls  
—dozens of uses—  
carry it anywhere!

**Yes!** Send me  
bulletins checked

**THE TOLEDO PIPE THREADING  
MACHINE CO.**  
1445 Summit Street, Toledo 4, Ohio

☐ TOLEDO No. 78 Power Drive ☐ TOLEDO No. 68 Power Drive

Name

Address

City  Zone  State



BUILDERS OF THE WORLD'S FINEST PIPE TOOLS  
**TOLEDO**  
PIPE THREADERS • PIPE WRENCHES • PIPE MACHINES

THE TOLEDO PIPE THREADING MACHINE CO. • TOLEDO 4, OHIO

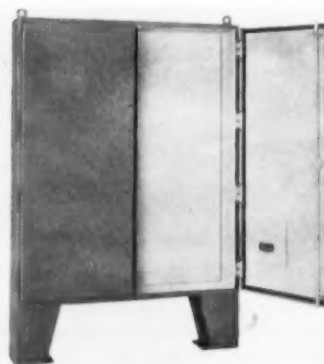


## Switch Boxes

(32)

Sectional switch boxes with beveled corners are now available in seven new types. Boxes with or without plaster ears, leveling bumps and mounting brackets for either side or face mounting are available without clamps. Standard boxes with clamps and plaster ears are offered without leveling bumps. Features include: clamps with nested fit for easy wire pulling; knockouts and pri-outs designed for fast removal; smooth, embossed ridges upon which cable rests and is securely held. A choice of clamp screws which emerge from either beveled corner or bottom of box permits mounting on either face or side of studs. "B" and "V" brackets with lanced nailing points and nail holes are also available for face or side mounting to studs. Literature is available.

Keystone Manufacturing Co., 23328  
Sherwood Road, Center Line, Mich.



## Enclosures

(33)

Eight sizes of 2-door NEMA 12 panel enclosures ranging from 54 in. by 42 in. by 8 in. up to 72 in. by 60 in. by 12 in. have been added to the existing single-door line. These steel liquid-tight enclosures utilize all welded seams. The offset doors are gasketed with Neoprene sponge and are secured by a locking handle with a three-point latch. The enclosures have a 12-in. stand for floor mounting and lifting eye bolts.

Hoffman Engineering Corp., Anoka,  
Minn.

# FIRST

with a  
**COMPLETE LINE**  
OF  
**SAFETY**  
**SWITCHES**  
to meet the  
**NEW NEMA**  
**STANDARDS**



• The table below shows Square D switches meeting new industry specifications. Notice how they clarify conflicting features which existed under old designations. Notice, too, that they establish a new, heavy-duty industrial switch, Type HD.

One important thing which remains unchanged is the **DESIGN LEADERSHIP** which has made **SQUARE D SAFETY SWITCHES** industry's overwhelming **FIRST** choice for more than fifty years. Compare them, feature for feature. They cost no more, why settle for less?



TYPE HD



TYPE ND



TYPE LD

DESCRIPTION	HEAVY DUTY New	NORMAL DUTY Formerly Types H, S, or A	LIGHT DUTY Formerly Types D or G
Rating-Ampere Voltage	30-600 250 or 600V AC, DC	30-1200 250 or 600V AC, DC	30-200 250V AC
Enclosure	NEMA 12 • Industrial Use (Gasketed) NEMA 4 & 5 • Water-tight & Dust-tight NEMA 7 • Explosion-resisting Class I-Group D NEMA 9 • Explosion-resisting	NEMA 1 • General Purpose NEMA 3R • Raintight	NEMA 1 • General Purpose NEMA 3R • Raintight
Horsepower Rating	NEC Fuse Ratings Dual-Element Fuse Ratings	NEC Fuse Rating Dual-Element Fuse Ratings	NEC Fuse Rating
Operating Mechanism	Quick-Make, Quick-Break Independent of Handle	Quick-Make, Quick-Break Independent of Handle	Positive Make, Positive Break Spring Assisted
Cover	Interlocked & Padlock Attachment	Interlocked & Padlock Attachment	Padlock Attachment
Plating-Current Parts	Extra-Heavy Silver	Silver	
Endurance	Maximum Endurance Far Exceeds UL Standards	Exceeds UL Standards	Meets UL Standards

NOW... EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!



## SQUARE D COMPANY



# VERSA-LUX.

There's unmatched versatility in this new Versa-Lux family, together with a designed-in simplicity of straight-line styling that will satisfy any lighting need.

Wide unbroken surface planes, made possible by rigid hinged steel doors, provide maximum visual continuity. Doors with center mullions are also available to provide a greater selection of media.

Versa-Lux—in two widths for two, four and six lamps\*—is now available with these glass and plastic lens and panel closures—Holophane Lo-Brite® Controlens® #6016 Flat Plastic, #9016 Flat Crystal, Dished Crystal, Corning #93 Alba-Lite, Polystyrene Plastic Egg-Crate, Honeylite® aluminum louver, or Flat Acrylic Plastic—all of them with fine-ribbed plastic side panels. Versa-Lux installation is simple and versatile; maintenance is minimal.



No matter what kind of lighting you're looking for, at whatever price—Versa-Lux can be the answer, for its versatility is limited only by your own imagination, and its price is set to meet any budget.

*\*Rapid Start only.*



*Versa-Lux specifications available on request.*

®Holophane Co., Inc. ®Hexcel Products, Inc.

**CURTIS LIGHTING, INCORPORATED**

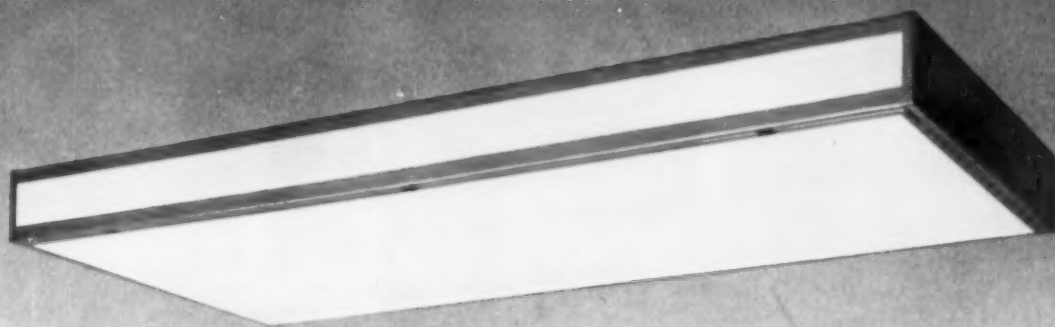
6135 West 65th Street, Chicago 38, Illinois

Versatile Versa-Lux/install them direct-ceiling-mount, partially recessed or pendant mount, individually, in continuous lines or in patterns.



SURFACE MOUNT    PARTIALLY RECESSED    PENDANT MOUNT

In California: 242 S. Anderson St., Los Angeles 33, California • In Canada: 195 Wicksteed Ave., Toronto 12, Canada



**...BY CURTIS**



TWO LAMPS

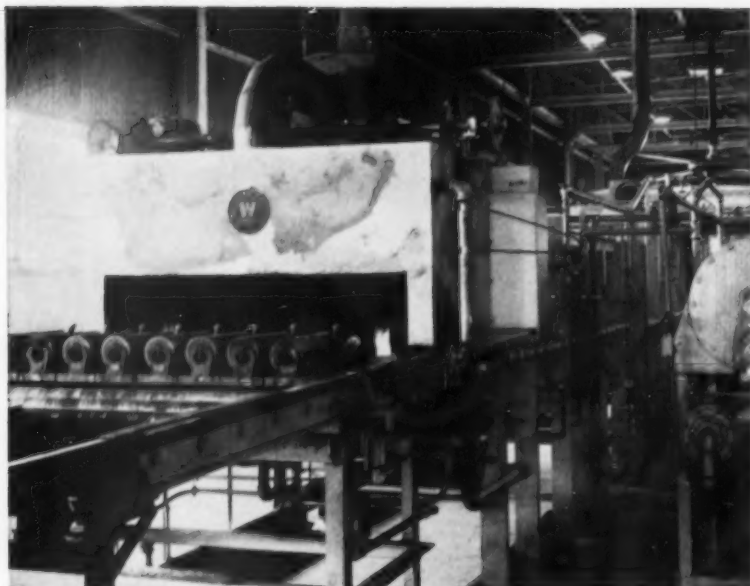


FOUR LAMPS



SIX LAMPS

Versatile Versa-Lux/available in two widths for two, four and six lamps and seven different bottom closures.

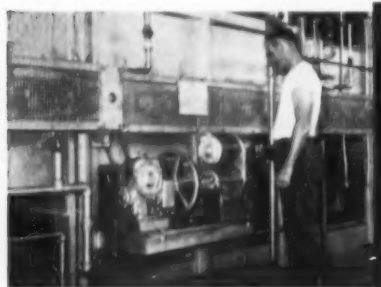


## How does ONAN Emergency Electricity protect this electric roller hearth furnace?

This furnace operates at 1400° F. Inside are a series of steel rollers driven by an electric motor, which turn at low speed and move pallets loaded with metal parts through the furnace. If these rollers should stop turning for as short a period as 5 minutes . . . deformation will occur and the rollers must be replaced. This is a very costly repair.

To guard against this loss and to keep the furnace operating, the company installed an Onan 3,500-watt emergency electric plant with completely automatic controls. Now . . . if regular service is interrupted, the plant starts automatically and takes over the power load. It keeps the three ½ H.P. electric motors running and supplies 1,000 watts for emergency lighting.

Where an industrial process cannot be interrupted without serious loss . . . an Onan Emergency Electric Plant may pay its entire cost several times a year. Ask your consulting engineer, or electrical contractor about Onan Standby Power . . . or write us for information.



This is one of the electric motors on the emergency power circuit. Power is transmitted through the gear reducer in the foreground to drive furnace rollers at very low speed.



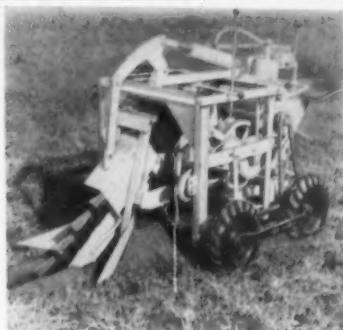
The Onan 3,500-watt emergency plant is installed in the plant 300 feet from the furnace. Automatic start and stop control is located near the furnace.

WRITE FOR FOLDER ON EMERGENCY POWER



**D. W. ONAN & SONS INC.**

2909 UNIVERSITY AVENUE S.E., MINNEAPOLIS 14, MINNESOTA



### Ditcher

(34)

A new model, W-2 Pow-R-Ditcher has been developed to answer the need for a narrow, shallow ditch in the gas, electrical, telephone, water service fields, and for lawn sprinkler systems. It has a digging width of 2½ in. to 4 in. wide and will dig to a 36-in. depth at a speed of 1 ft to 10 ft per minute. Over-all length is 10 ft, width 48 in., height 51 in. It is powered with either a model 23B Briggs Stratton or a Wisconsin AEN engine. It features a hydraulic boom lift with a 2-way hydraulic cylinder. Ditcher rides on pneumatic rubber tired wheels and has 4-wheel drive for both digging and transporting.

Vermeer Manufacturing Co., Pella, Iowa.



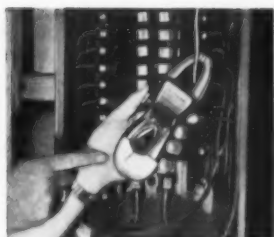
### Portable Heater

(35)

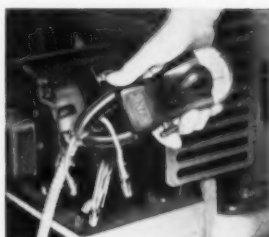
A new and complete line of portable electric heaters. The 240-volt heaters are available in 2000, 3000, 4000 and 4800 watts with the 208-volt units in 2000, 3000 or 4000 watts. All heating cones are of the new "Guide-Ray" design to focus extra radiant heat. A double-grill design lets convection heat pass through freely. Handle is located on rear panel and never becomes heated. Entire rear panel and cone assembly is easily tilted away from grill for cleaning. Automatic temperature control is assured through built-in thermostat. Two, three, four and five-cone units are available to fit any specific heating requirement.

Everwarm, Inc., 3600 Pleasant Ridge Road, Knoxville, Tenn.





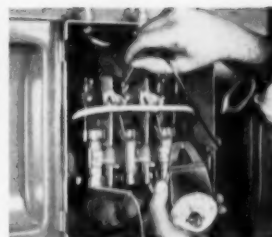
Show need for additional service



Take current readings without shutdowns



Check appliance current at plug



Instantly determine if fuses are good



Know if load is balanced

# 13 different jobs that call for an AMPROBE



Determine hot leg of receptacle



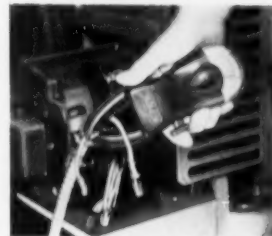
Check capacity of motor capacitors



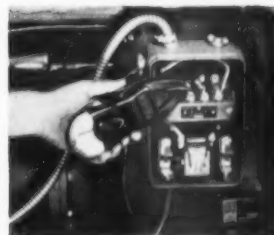
Use for periodic motor checks



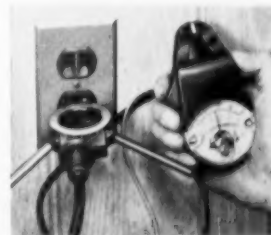
Know if windings are grounded



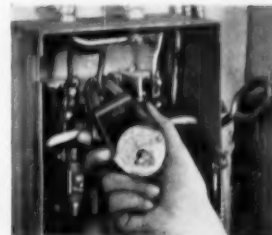
Determine motor overloading



Trouble shoot relays quickly



Check appliance voltage at receptacle



Use for lighting circuit surveys

Don't guess at it. *Amprobe it.*

You'll save time, money, and costly mistakes on the job by reaching for your Amprobe. It's not just an ammeter, not just a voltage-tester. It's both! Amprobe measures voltage and current—instantly, accurately, safely—without shutting down equipment. And there's a model that fits your needs perfectly.

Expensive? Not all all. You can select an Amprobe for as little as \$19.85—just a few dollars more than an ordinary voltage-tester. See your electrical wholesaler today.

Amprobe is a division of Pyramid Instrument Corp., 630 Merrick Road, Lynbrook, New York, manufacturer of REMCON simplified low-voltage switching devices.

## AMPROBE

### 13 models to make your work easier, faster, surer

*There's a model for every job, every budget: from 10 amps and 250 volts to 1200 amps and 600 volts AC; from \$19.85 to \$67.50.*

# Your Nearest Distributor

is your best stockroom

By always having Arro Anchoring and Drilling Devices on hand, your nearest industrial supplier, wholesale hardware, or electrical supply house can enable you to keep production up, while keeping your inventory costs down.



*Always Specify*



COMPLETE LINE

**ANCHORING AND DRILLING DEVICES  
FOR ALL MASONRY**



SPIRAL-DRIVE NAIL ANCHOR



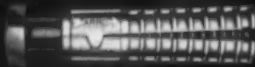
LEAD SCREW ANCHOR



STUD BOLT ANCHOR



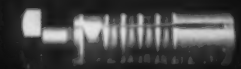
MAL-LEAD BOLT ANCHOR



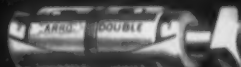
LAG SCREW EXPANSION SHIELD



A-C-E EXPANSION SHIELD



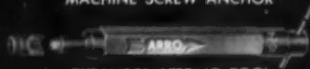
O-E EXPANSION SHIELD



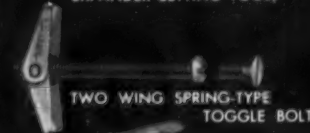
DOUBLE EXPANSION SHIELD



MACHINE SCREW ANCHOR



EXPANDER SETTING TOOL



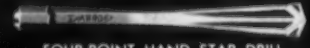
TWO WING SPRING-TYPE  
TOGGLE BOLT



NO. 5 TUMBLEHEAD  
TOGGLE BOLT



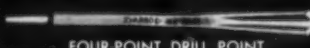
ARROFLUTE CARBIDE MASONRY DRILL



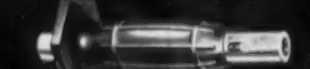
FOUR-POINT HAND STAR DRILL



TWIST DRILL POINT



FOUR-POINT DRILL POINT



RUBBERGRIP DRILL POINT HOLDER



LITTLE MAJOR TURNBUCKLE



See your industrial, hardware or electrical supplier  
**ARRO EXPANSION BOLT COMPANY**

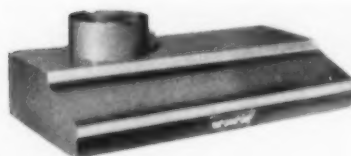
1540 Boone Ave., Marion, Ohio



## Constant Ringing Drop (36)

A constant ringing drop, designed particularly for alarm systems where immediate attention is required for protection of personnel and equipment, and where reset feature is needed for restoration of alarm system. Constant ringing drop is particularly well suited for many types of industrial control alarms, fire alarm systems and annunciators. It operates in the low-voltage circuit that may be supervised by thermal, liquid level, tachometer switch, voltage or current relay, or other device sensitive to specific conditions. When controlled condition is returned to normal, warning devices can be silenced or cut out by means of a reset button under the drop. Drop will re-cycle with the return of alarm conditions. Drop No. 26 is for 6-8 volt dc or 8-12-volt ac circuits.

Edwards Company, Inc., 90 Connecticut Ave., Norwalk, Conn.



## Ventilating Hood (37)

A new range hood, featuring push-button control of fan and light. The new series of hoods incorporate an 8-in. ventilating fan, No. TC8, with grill filter and a glare-free light with reflector plate. Entire unit is pre-wired so that all is required is to bring a "hot" line to the switchbox of fan. Left and center openings are standard on hoods with a right-hand opening also available. Standard sizes are 30 in., 36 in. and 42 in., all 11½ in. deep at the mounting surface to fit all cabinets 11½ in. to 13½ in. deep. Standard finish is coppertone, with white available; splash plates may also be had in both colors.

Berna Air King Corp., 3050 North Rockwell St., Chicago 18, Ill.

WHEN HE SAYS CLIFTON  
I know he uses the  
best Conduit made.



Clifton Rigid Conduit

More and more architects, contractors and designers are specifying CLIFTON Conduit. The real fact is this—CLIFTON is thoroughly dependable, there is none better made. I standardized on CLIFTON a number of years ago and stopped switching. It made my jobs go faster because CLIFTON Conduit is always uniformly high quality. Believe me, nothing equals the uniform protective coating of zinc inside and outside, as applied by CLIFTON'S special "hot-dip" method.

Remember this — a CLIFTON raceway installation permits easy rewiring, should it be necessary to accommodate the ever increasing demands of electrical loads, as emphasized by the national adequate wiring program. In this regard, CLIFTON Flexible Steel Conduit is especially easy to install and allows flexibility in your installations.



CLIFTON Flexible Steel Conduit

Clifton E.M.T.

Here is my suggestion. Standardize on CLIFTON Conduit. Get all the extra value that CLIFTON puts into their Rigid, E.M.T. and Flexible Steel Conduit, and in addition insure the integrity and easy flexibility of all your jobs. CLIFTON Rigid and E.M.T. Conduit are approved by Underwriters' Laboratories, Inc., conforms with Federal Specifications WW-C-381C, WW-T-806B; and ASA Specifications C-80.1 — 1953, C-80.3 — 1953.

Your Best 2 Word Specification  
CLIFTON CONDUIT

Other CLIFTON Quality Products:

CLIFTON Plastic Covered Steel Conduit  
CLIFTON Armored Cable  
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CLIFTON (Cliftra) Non-Metallic Sheathed Cable  
CLIFALL UF CLIFTON Building Wire TW-R-RHRW-BR-S-SJ  
CLIFTON Elbows and Couplings

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WIRE — CABLE — RIGID CONDUIT — ELECTRIC METALLIC TUBING — CLIFALL UF

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JANUARY, 1957

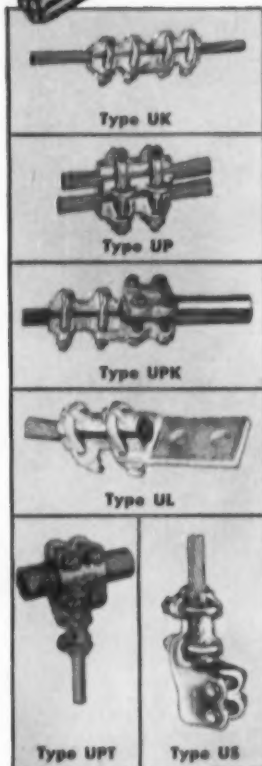
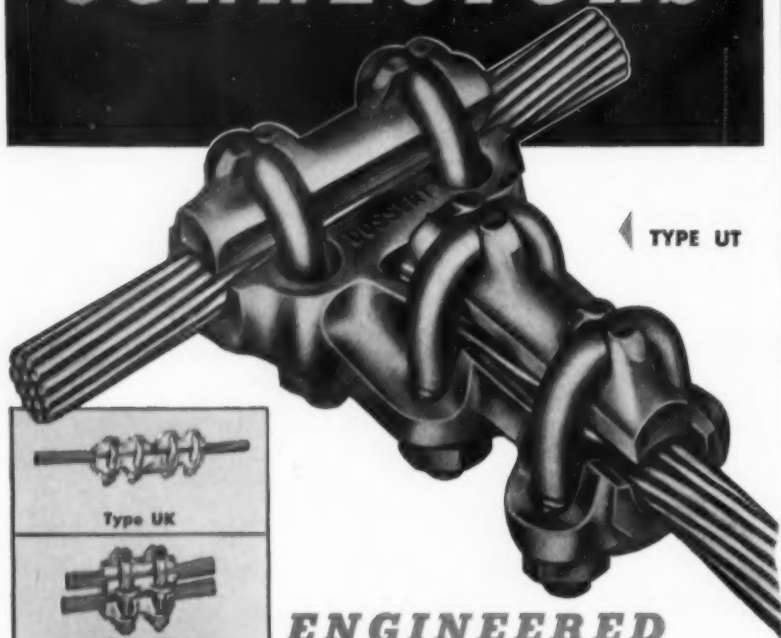
# Fast to make fast!

Safe, swift cable connections with

## DOSSERT

### U-BOLT

## CONNECTORS



## ENGINEERED FEATURES:

### VARIABILITY

Fits many cable sizes, reduces number of connectors needed for given number of combinations of conductors.

### HIGH CLAMPING ACTION

U-Bolts clear all conductors by close limits, supported by saddles through their full arcs. Minimizes bending action, makes U-Bolts subject to tensile stress only.

### CABLE END RELIEF

Allows for distortion in free ends of strands, ample room for binding end of stranded cable if desired.

### CONDUCTIVITY

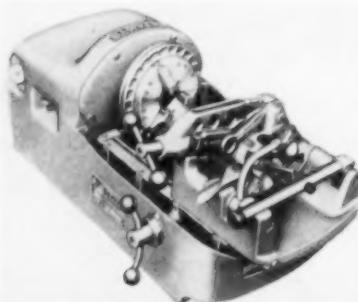
High copper alloy with sufficient contact area to insure cooler-than-conductor operation under maximum load.

Representatives in all principal cities.  
IN CANADA: W. S. Gerrie & Assoc., Ltd., Toronto

WRITE FOR DETAILS AND PRICES TODAY!

**DOSSERT MFG. CORP.**

249 Huron Street, Brooklyn 22, N. Y.



Pipe and Bolt Machine (38)

A new portable pipe and bolt machine, known as "Speed-O-Matic". It threads 1/8-in. to 2-in. pipe, 1/4-in. to 2-in. bolts, up to 12-in. with a drive shaft. Recessed motor switch is fully protected. Power-grip wrenchless chuck is standard equipment. New "Clear-Vu" self-centering wheel-and-roller cutoff allows operator to see cut being made at all times. A special oiling tube directs oil to the threading dies. It shuts off automatically when moved out of position. A vane type, quick-acting, pulsating flow pump produces even distribution of oil to all die segments. It is 35 1/2 in. long and 20 in. wide.

Beaver Pipe Tools, Inc., Warren, Ohio.

## Mercury Vapor Lamps (39)

Two new yellow mercury vapor lamps, E-HI-Y and J-HI-Y, for use in calling attention to hazardous conditions or locations on streets and highways. The lamps are also intended for floodlighting and other applications where yellow light is appropriate. Color of lamps suggests a definite caution when used at intersections, dead-ends, curves, turn-outs, railroad crossings, and similar danger spots that require special traffic control. The E-HI-Y provides the same efficient light distribution pattern as the standard E-HI, with minimum loss in illumination levels. It is most satisfactory when installed singly or in groups at hazardous points in a mercury street lighting system. The J-HI-Y has a richer yellow color than the E-HI-Y. It provides a wider distribution of light from the luminaire due to the larger size of the light source.

Westinghouse Electric Corporation, Bloomfield, N. J.

## Disconnect Panel (40)

A new 100-amp master disconnect panel specifically designed for those areas where local electrical codes require the use of a master or overall disconnect switch on residential services. Device has a 100-amp two-fuse master pullout switch. Switch controls eight single-pole plug fuse branch circuits useful for lighting





In Taconite processing plant, ANACONDA Interlocked-armor cable is used for feeder line . . . resists weather and industrial hazards.

## New cable puts power where you want it—fast!

With ANACONDA Interlocked-armor cable you bring power to new load centers faster—change plant layout quickly, or add new facilities in a hurry!

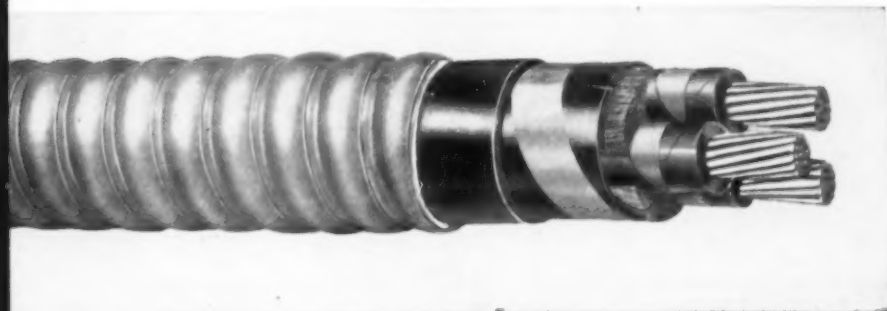
It is economical—installed fast—indoors or out—with simple supporting devices . . . trained easily around corners, columns and other obstruc-

tions in long unbroken runs. Circuits are easy to relocate . . . always accessible. And this cable's interlocked metal-tape armor affords high mechanical protection against all types of damage.

The Man from Anaconda, or your nearest Anaconda distributor, will be happy to give you full information. Or write to: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

643108

ASK THE MAN FROM **ANACONDA**  
FOR INTERLOCKED-ARMOR CABLE



Anaconda Interlocked-armor cable comes in sizes No. 6 Awg to 750 Mcm—copper or aluminum—up to 15 kv—Underwriters' approval for 600 volts and 5000 volts. Available with rubber-, plastic- or varnished-cambrie-type insulation.





Mr. W. Nick Tune, Bond Electric Co., Nashville, Tenn.

## "Fewer parts to put together"

"Fewer parts to put together and greater ease in hanging are outstanding features of Day-Brite fixtures.

"We like the fact that they are factory assembled and come to us in individual wax-lined containers. You can tell the minute you open the carton that the Day-Brite people have good engineers. There's no problem with breakage and the fixtures are not just thrown together.

"All in all, we're for Day-Brite—they make it easy for us to figure our labor costs and come out with a clean profit."

The fact that contractors all over the country feel the same as Mr. Tune is responsible for Day-Brite's steady increase in acceptance.

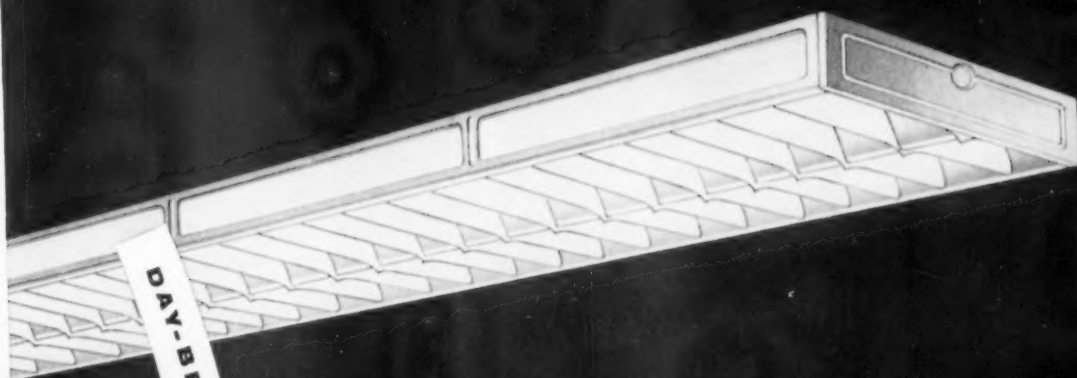


DAY-BRITE LIGHTING, INC.

5402 Bulwer Avenue, St. Louis, Missouri

**NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT**

DAY-BRITE ON-THE-JOB MAKES THE BIG DIFFERENCE HERE



### Not three...JUST ONE!

You save time on the job with Day-Brite Plexoline because the fixture comes to you complete in one carton with top plates and side panels already factory assembled. Remember, it's the installed cost that decides your profit.

71107

## WEEKLY TIME CARD

Name John Smith  
 Time Card for Week Ending Jan 12 195 7  
 Job No. 123 Job Description Third National Bank

HOURS		MON	TUE	WED	THU	FRI	SAT	SUN
From	To							

## Blackhawk's NEW One-piece Box Support

# Speeds up work

## Simple

A single piece that goes in easily and stays put — frees the electrician's hands for the work.

## Quick

The Blackhawk patented one-piece box support is installed all at once — permits more jobs, more profits.

## Permanent

The Blackhawk box support provides rigid, unified support because it is a large, single piece — does not wiggle or saw, because it is parallel to the wall.

## Superior installation in seconds



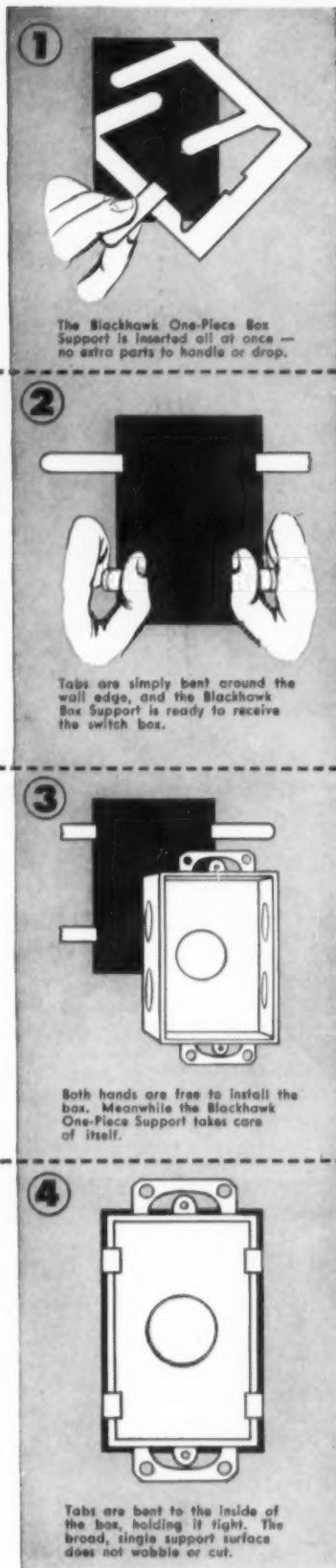
Ask Your  
Electrical Distributor

Cat. No. 540  
Patent No. 2518912

Specify B-1 when you buy!

# BLACKHAWK INDUSTRIES

DUBUQUE, IOWA



and small appliance circuits as well as two 60-amp and two 30-amp two-fuse branch pullout switches. These pullouts are used to control major electrical appliances. Available with surface or flush trims, the enclosures are 18 in. high by 14½ in. wide by 3½ in. deep which permits them to fit between 16-in. centered studs for flush mounting.

General Switch Co., 45 Roebling St., Brooklyn 11, N. Y.

## Lamp Ballast

(41)

A new fluorescent lamp ballast, the smallest ever provided for the operation of two F96T12 lamps at 430 ma. Due to its reduced operating temperatures, unit will be easier to apply for fixture manufacturers and will have longer life. Despite reduction in physical size, rated light output, rated starting current and rated open circuit voltage in accordance with CBM specifications, have been maintained. Developments which have made possible the low sound rating for the new ballast are the exclusive 3-piece core assembly with special push-on clamps, reduced core length, cemented gaps, special coil wedges, and G-E's lift-compound pour. Designated 6G-1010, the ballast is 1-25/31-in. high, has an overall length of 11½ in. and a mounting length of 11¼ in.

General Electric Co., Schenectady 5, N. Y.

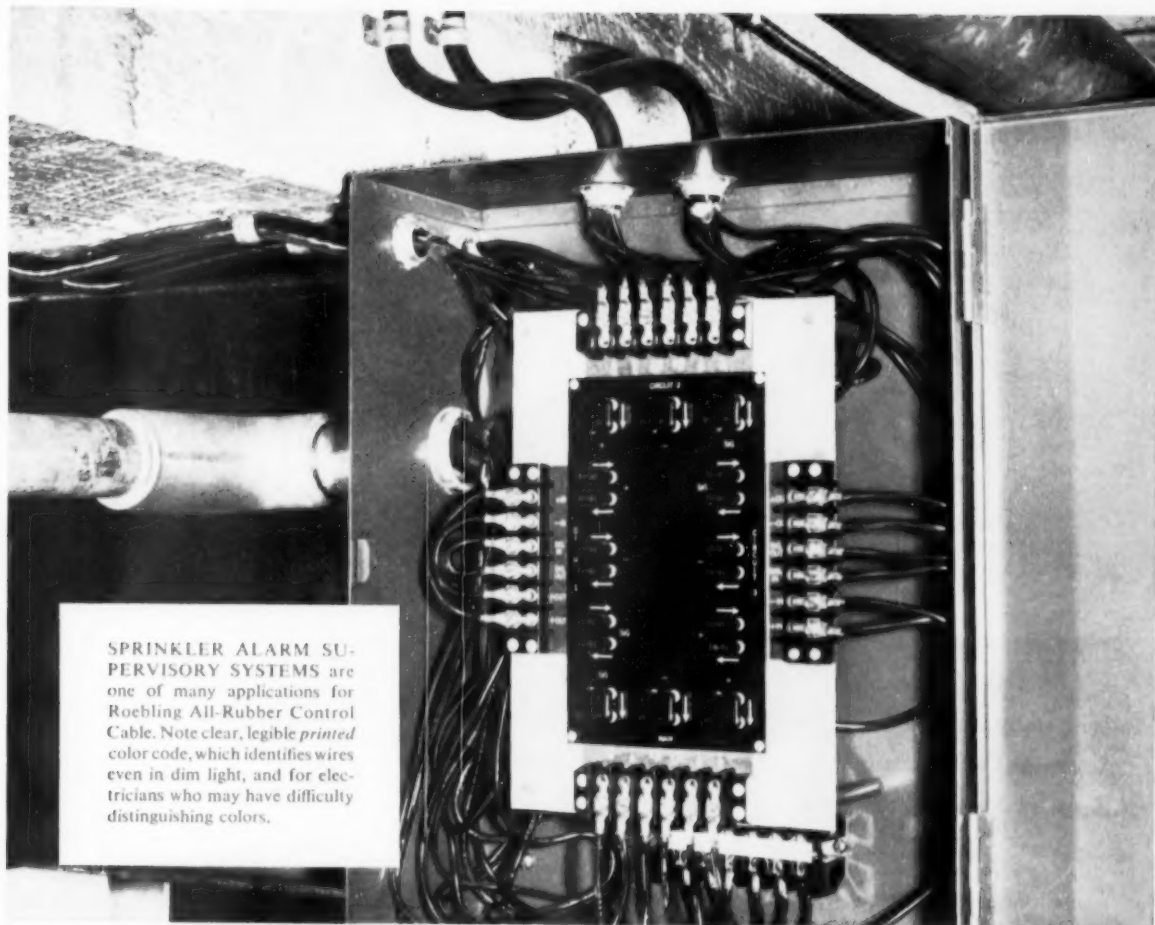


## Indicator

(42)

A new ac ground contact indicator for hospital operating rooms and similar hazardous locations. Indicator detects a grounded conductor in circuits feeding ungrounded systems. It provides both visible and audible alarm when any such isolated circuits become grounded. Less than 2 ma leakage current is needed to trigger the alarm. Indicator is available separately or with necessary isolating transformers and distribution panels for ungrounded systems.

Gemco Electric Co., 25681 W. Eight Mile Road, Detroit 19, Mich.



SPRINKLER ALARM SUPERVISORY SYSTEMS are one of many applications for Roebling All-Rubber Control Cable. Note clear, legible *printed* color code, which identifies wires even in dim light, and for electricians who may have difficulty distinguishing colors.

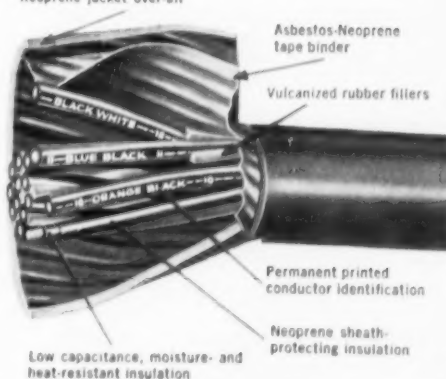
## *For dependable 24-hour-a-day duty, you need* **ROEBLING ALL-RUBBER CONTROL CABLE**

**New Roebling All-Rubber Control Cable is built to fight off water more effectively than other control cables.**

The reason is its completely non-hygroscopic construction. A special low capacitance, moisture- and heat-resistant insulation, plus a jacket of Neoprene, covers each conductor. Interstices are completely filled with shaped vulcanized rubber fillers. An asbestos Neoprene tape, which binds the cable core during processing, is made an integral part of this tough, over-all Roeprene® sheath.

Wicking or longitudinal migration of moisture is prevented. Splicing and terminating are made easy by the strip-free conductors . . . and each conductor is clearly identified by indelible printing. Write today for more facts about how this unusually practical control cable can save you money and man-hours.

Roeprene jacket over-all



ROEBLING ELECTRICAL WIRES AND CABLES ARE AVAILABLE WITH EITHER COPPER OR ALUMINUM CONDUCTORS

# **ROEBLING**

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J.

Branch Offices in Principal Cities • Subsidiary of The Colorado Fuel and Iron Corporation



ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JANUARY, 1957

# Supermarket spans years of construction progress...

## USES *Ramset*®!



**Ramset System**  
saves \$10,000 and  
two months' time  
for new Ft. Wayne  
Supermarket



Using the latest construction methods, contractors completed Eavey's Supermarket in Fort Wayne, Indiana, ahead of schedule and ahead of budget!

The electrical contractor reported hanging 10,000 feet of conduit carrying 350,000 feet of wire, with RAMSET, using 100,000 fasteners for the job. About \$10,000 and two full months were saved by using speedy RAMSET SYSTEM, according to George Clement, service engineer for Eavey's. Other contractors saved in the same way.

RAMSET FASTENING SYSTEM can be used in a variety of ways on most jobs: electrical, plumbing, air conditioning, door, window and wall installations. Moreover, RAMSET is just as valuable in the plant maintenance operation as to the original builders and contractors.

You can anchor almost anything to concrete and steel with RAMSET. New catalog is ready, send for your copy now.

companion tool

**Shure-Set**  
TRADE MARK

Baby brother to RAMSET, this hammer-in tool uses no cartridge, but makes your own hammer power more effective. For masonry, mortar joints, cinder block. Ask for literature.

### *Ramset Fastening System*

WINCHESTER-WESTERN DIVISION  
OLIN MATHIESON CHEMICAL CORPORATION

12105-A BERE A ROAD

CLEVELAND 11, OHIO

#### Ballast

(43)

A new ballast that is 27% lighter in weight than the model it replaces has been designed for operation of two 4-watt switch-start lamps at 118 volts. Designated 6G1000, the unit is also available in the smaller brickette case. Superseding models 89G983 and brickette catalog 89G343, the new smaller cross-section ballast represents a weight reduction of 1½ lbs from the previous shallow height brick model. In the brickette cross-section, the CBM-certified 6G1000 will fit all existing 40-watt small cross-section channels.

General Electric Co., Schenectady 5, N. Y.

#### Product Briefs

(44) A new completely automatic idle control accessory for Model 35A115 generator has been announced by Homelite, Port Chester, N. Y. . . .

(45) Fasco Industries, Inc., Rochester, N. Y. has developed a 20-in. automatic window fan, Model 2087. . . . (46) New re-rated motors with six improvements have been developed by Robbins & Myers, Inc., Springfield, Ohio.

(47) A new type rectifier for cathodic protection against corrosion has been introduced by the Holcombe Company, Shreveport, La. . . . (48) Lightolier, Inc., Jersey City, N. J., has developed a new series of modular lighting units, the Calculites. . . . (49) A new and improved single lamp infrared brooder designed for chicks and also for supplying radiant heat for pigs, lambs and calves, has been announced by Steber Manufacturing Co., Broadview, Ill.

(50) A professional-type burglar alarm designed for homeowners and apartment dwellers, called the Alarmco "Watchman", provides protection from intruders and is produced by Alarmco, Inc., New York City. . . . (51) A self-contained built-in refrigerator-freezer has been introduced by the Thermador Electrical Manufacturing Co., Los Angeles, Calif. . . . (52) Fasco Industries, Inc., Rochester, N. Y., has introduced a budget priced series of window fans called the "Slim Line".

(53) Lightolier, Inc., Jersey City, N. J., has introduced the "Patrician" lighting fixture collection for residential use. . . . (54) A new timer for controlling "on-off" cycles from 10 seconds to 12 minutes has been announced by International Register Co., Chicago, Ill.

(55) Forsberg Manufacturing Co., Bridgeport, Conn., has introduced two new models of the original Whiz-Saw. . . . (56) A new type of stud gun based on design innovations has been announced by the Le Belier Stud Gun Corp., Miami Beach, Fla. . . . (57) A new combination spotlight electrical circuit continuity tester, No. 1618CT, featuring an industrial flashlight with built-in jack, is being marketed by Bright Star Industries, Inc., Clifton, N. J.



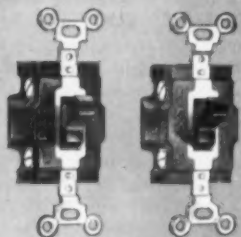
# FOR DEPENDABLE SERVICE

## ON HEAVY DUTY JOBS

**P&S**

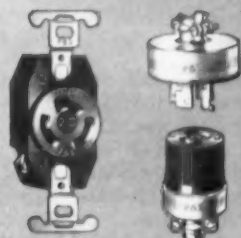
THE BEST  
COMES FROM **P&S**

Over 65 years of leadership in the wiring device field have taught the industry to look to Pass & Seymour for the Precision Manufacturing and Creative Engineering that means stronger, longer-lasting, simpler-to-use wiring devices.



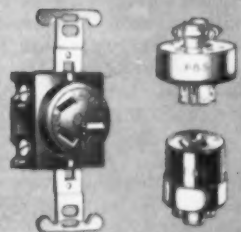
### P&S SUPER AC SWITCHES

Pass & Seymour-engineered for extra long life on HEAVY DUTY service. P&S Super Switches can be used at full rated capacity on fluorescent, incandescent, and inductive loads, and can control motor loads up to 80% of switch rating. Rated 15 and 20 amperes, 120 Volts A.C. to 277 Volts A.C.



### P&S TURNLOK® LINE

Heavily armored caps . . . sturdy, two piece bodies for longer life. Easy back or side wiring. Available in 10 and 20 amperes — 2, 3, and 4-wire types. Modern face design plainly indicates ampere ratings on all receptacles.



### P&S POLARIZED DEVICES

Extra heavy bodies and extra heavy metal parts withstand hardest wear for longer periods of time. All receptacles have extra design features to make installation easy and quick. Available in 10 and 20 amperes — 2, 3, and 4-wire connectors, receptacles and caps.

For wiring device quality, always look for these outstanding devices.

The original Despard Line®  
P&S Surfex®

Roto-Glo® Switches

Uniline® Wall Plates

Alabax® Fixtures

Complete line of Switches,  
Outlets and Lampholders

Every year, more Pass & Seymour wiring devices are sold. The strength, durability and, most important, the speed and simplicity of installation of all P&S products make them the specified choice of electrical contractors everywhere.

Write Dept. ECM-22 for full listings and descriptions of these and all other types of wiring devices in the complete quality Pass & Seymour line. For accuracy's sake—order only by P&S catalog number.



**PASS & SEYMOUR, INC.**

SYRACUSE 9, NEW YORK

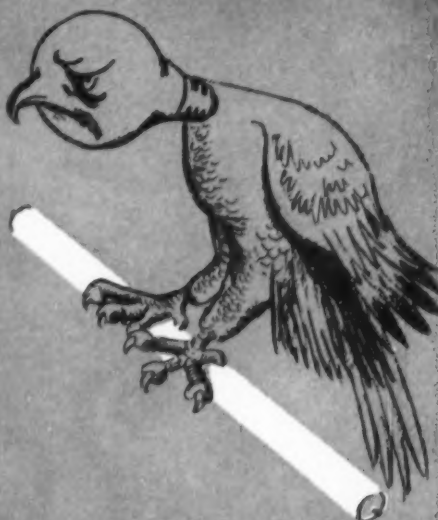
71 Murray St., New York 7, N. Y. 1229 W. Washington Blvd., Chicago 7, Ill.

In Canada: Renfrew Elec. & Refrig. Co., Ltd., Renfrew, Ontario

# LOCK OUT THE LIGHT HAWK

WITH  
THIS  
DIAMOND  
MARK  
OF  
QUALITY

## CHAMPION



Champion Incandescent and Fluorescent Lamps protect your investment in lighting. They have a 57-year reputation for converting current into good light at lowest cost per year.

Champion Incandescent and Fluorescent Lamps provide sound, low cost assurance of good, dependable light sources. Their ability to burn bright and long is insured by over 200 inspections.

IT MEANS YOU'RE GETTING  
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MONEY IN LAMPS

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## CATALOGS and BULLETINS

(58) FUSE LINKS—their application and coordination—are described in 16-page bulletin. Dimensions, time-current curves, construction features, and application information are included. Line Material Co.

(59) ARMORED CABLE for voltages through 15,000 volts, single and multi-conductor. Arranged in table form are correlated listings of the most frequently used dimensional data, including conductor size, stranding, insulation, sheath and armor thickness, approximate outer diameter and weight per thousand feet. Coordinated support system and fittings for use with the cable are discussed. 24 pages. National Electric Products Corp.

(60) MOTORS featuring a specially treated corrosion resistant steel housing which offers protection against all adverse weather conditions are described and illustrated in 8-page bulletin. Other features of re-rated all-weather motors covered include end-to-end ventilation, sealed prelubricated bearings, and sealed terminal box. Bulletin 520. Robbins & Myers, Inc., Industrial Motor Div.

(61) FLUORESCENT LAMPS with built-in directional reflectors for commercial and industrial applications. 4-page brochure provides photos and distribution curve for lamp designed to increase the amount of usable light in high-ceiling installations where bare lamps are used without reflectors or where reflectors soil easily. Sylva Electric Products Inc.

(62) FLOOR Box and service fittings. 4-page bulletin includes dimensional data, photographs and descriptions of component parts and service fittings permitting installation of standard receptacles in die-cast aluminum housing less than three inches high. "800" series is available from 2½ to 3½ in. National Electric Products Corp.

(63) AC MOTORS are graphically illustrated by cutaway views showing details of design permitting use for applications formerly requiring drip-proof or splash-proof construction. 4-page, 2-color bulletin. Reliance Electric and Engineering Co.

(64) TAPE with silicone polymer adhesive for Class H insulating applications. 4-page folder gives specifications and prices for roll widths of 1 to 2 in. Connecticut Hard Rubber Co.

(65) AC MOTORS for most commonly used electric power drives are listed in 20-page condensed catalog covering normal speed motors, geared motors, variable speed transmission and speed reducers. Tables give model numbers, prices and operating data. Sterling Electric Motors, Inc.

(66) DRIVE ANCHORS. New pocket-sized brochure illustrates latest nail anchor application methods, including full technical data with proposed Federal specs on safe working loads. Brush Nail Expansion Bolt Co.

(67) AIR CONDITIONERS for individual room use are illustrated in color in wallet-size folder which includes a trade-in calculator. Sizes, model numbers and specifications accompany each illustration. Mitchell Manufacturing Co.

(68) CURRENT TRANSFORMER field test set for checking current transformer installations is described and illustrated in 4-page Bulletin No. 54-B. Wiring diagram shows connections for detecting troubles in faulty connections. Eastern Specialty Co.

(69) AC MOTORS—how to select for specific applications. 12 pages of tables give selection data on current, torque and frame sizes and speed-frequency relationships. Reliance Electric and Engineering Co.

(70) BAR HANGERS and bar sets with expandable feature for fitting any joist space up to 26 in. are illustrated and priced in 2-page Bulletin TOB-2. 2-piece stud permits outlet box to be engaged in seconds. Appleton Electric Co.

(71) PRIMARY FUSING of parallel-connected transformer banks is discussed and illustrated in Information Bulletin 203. A chart lists factors influencing choice of a fusing scheme and rates the schemes according to fault protection, continuity of service, emergency overload operation, coordination, single-phasing and initial cost. S & C Electric Company.

(72) GENERATOR CONTROL PANELS for generator, floor or wall mounting are illustrated and described in Form PAN 1156. Kato Engineering Co.

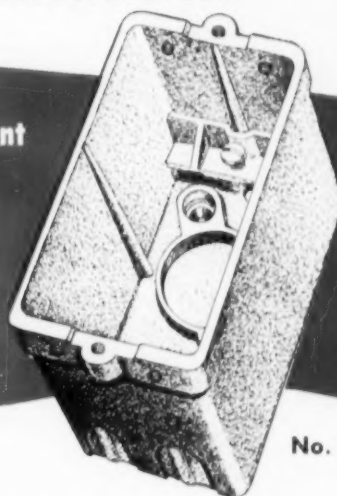
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- ✓ Insulating
- ✓ Strength
- ✓ Economical
- ✓ Flame Proof



No. 9311

**Plus...**  
these other fiber glass reinforced plastic (FRP) outlet boxes.



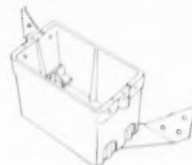
No. 9314-C, 4" Octagon box, has standard round knockouts ... available with or without FRP clamps.



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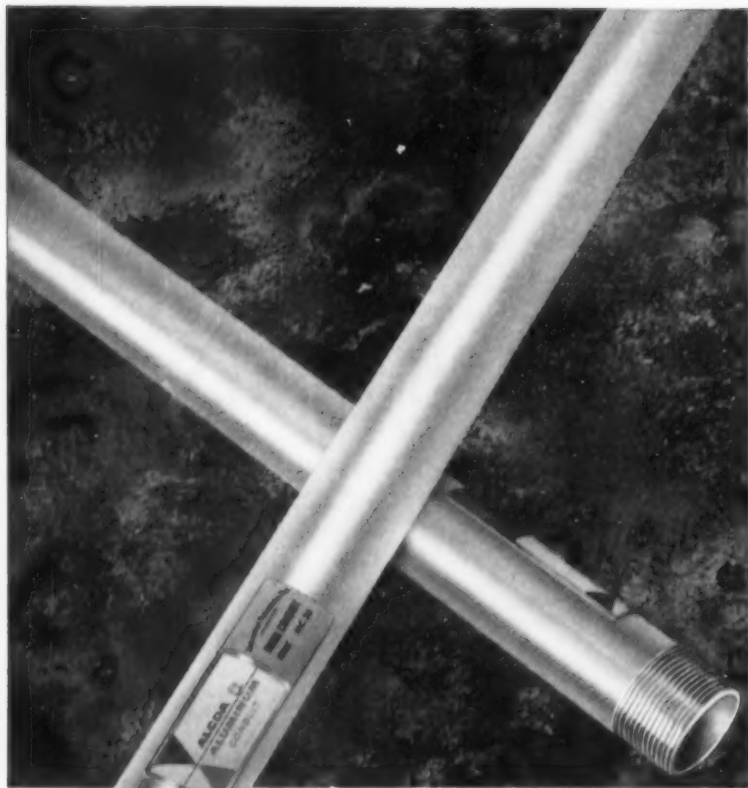
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(73) **SILICONES** used for electrical insulating materials and other products are listed in new 1957 Reference Guide. Charts, tables and graphs describe almost 150 products with application photos. 12 pages, two colors. Dow Corning Corp.

(74) **INFRARED BROODERS** in one, two, three, four and six-lamp assemblies illustrated and described with specifications and prices in Bulletin No. 130-57. Steber Mfg. Co.

(75) **HANGERS** and accessories for lowering inaccessible overhead lights to floor level for servicing. Bulletin TH-56 illustrates typical installations in high-bay buildings ranging from industrial plants to aircraft hangars. Included are ratings and general specifications for 2- and 4-pole hanger models, shock absorbers and operating chain and cable. Thompson Electric Co.

(76) **NON-METALLIC CABLE**, Type RR, USE, RH-RW and RHW. 40-page booklet contains appropriate charts covering size, strand construction, insulation sheathing, outer diameter and shipping weights plus data on current-carrying capacities. National Electric Products Corp.

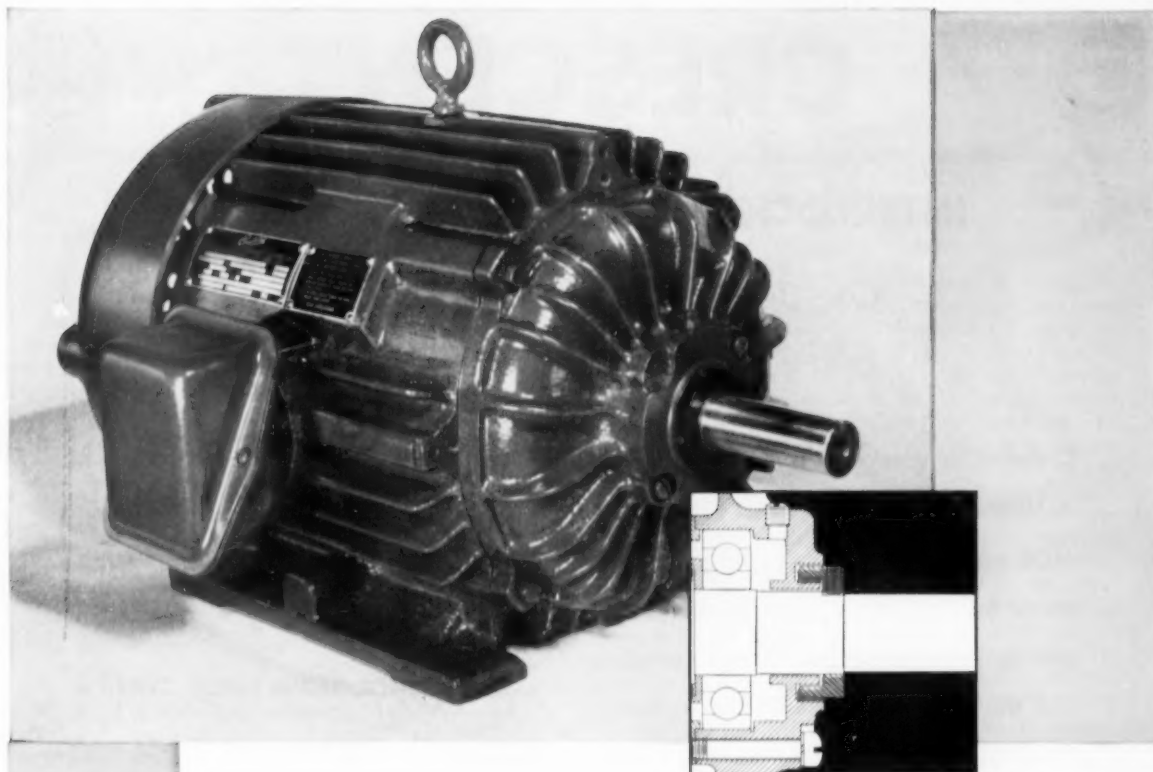
(77) **SWITCHES** for machine tools and other industrial equipment. Photos, drawings and tables of available types with various actuator designs plus diagrams of circuitry variations. 8-page foldout. Micro Switch, Division of Minneapolis-Honeywell Regulator Co.

(78) **STAPLE GUNS** for wire and non-metallic cable are pictured and described in new sales manual. Text includes pointers on proper use, specifies type and size staple for each model and type wire. Arrow Fastener Co., Inc.

(79) **MATERIALS HANDLING** equipment described in 44-page booklet includes lightweight hand hoists, spur gear hoists, ratchet hoists and trolleys in capacities from 1 to 40 tons. An article is included on "How to Select the Proper Type of Hoisting Equipment". Yale & Towne Mfg. Co.

(80) **INDUSTRIAL LIGHTING** booklet, "Prescribed Lighting Protects the Eyes of Industry" features sections on safety and visibility factors; standards for use in prescribing plant lighting; uses of fluorescent, incandescent and mercury vapor lamps; and condensed catalog on fixtures. 28 pages. Sylvania Electric Products Inc.





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# CRESCENT



## INTERLOCKED ARMOR POWER CABLE

*Can Be Easily and Quickly Installed  
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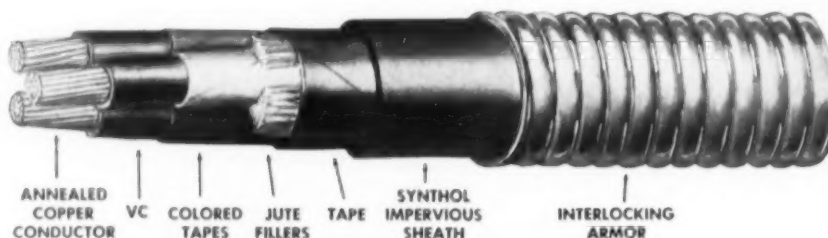
Crescent Interlocked Armor Cable with ALUMINUM or GALVANIZED STEEL ARMOR provides a flexible metal-enclosed method of wiring for power. Speed and economy of installation are the principal advantages of these cables since they can be placed on easily hung racks or attached to building surfaces.

Maximum current carrying capacity is secured by the use of the varnished cambric insulation. For outdoor or damp location installation, it is furnished with SYNTHOL IMPERVIOUS SHEATH between the insulated conductors and armor, as illustrated below.

### INTERLOCKED ARMOR CABLE

WITH IMPERVIOUS JACKET

Three Conductor-VARNISHED CAMBRIC INSULATED-O-5000 Volts



The Varnished Cambric insulated conductors are thoroughly protected by the Impervious Sheath of tough thermoplastic which is highly resistant to moisture, alk-

lies, acids and oils. This cable shows attractive savings when strung from messenger cable or in troughs outdoors as between buildings.

WRITE FOR BULLETIN

**CRESCENT INSULATED WIRE & CABLE CO.**

**TRENTON 5, NEW JERSEY**

# Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay \$5.00.

## Single Phasing of Motor on Primary Open

**QUESTION D31**—*The activity at which I work recently had one of the phases of an 11,000-volt primary open due to a cable failure. Before our main substation could be unlocked and the 11,000- to 4160-volt transformer be tripped out, we had a 20-hp, 220-volt, 3-phase motor single phase and burn up. The heaters in the motor controller were of the specified size for the 20-hp motor.*

*What can be applied to the 11,000-volt primary to open the other two phases when one phase is opened as in the above case? If there is such a device, how is it applied?—W.T.E.*

**ANSWER TO D31**—Excessive current due to single-phasing without the overcurrent protective devices being actuated by such excessive current has been frequently and vociferously brought up for discussion many times. Since the voltage is maintained in a rotating motor to near normal across all three terminals due to the phase generating voltage in the inactive circuit, a device which depends upon a drop in voltage will fail to respond. Two overcurrent protective devices such as you were employing are sufficient in cases where the transformers are protected by circuit breakers which open all three phases simultaneously in the event of a fault on one of the phases. Where there is no loss-of-phase protection, however, and one phase goes out, then on either a delta-star or on a star-delta connected transformer bank there will be a definite need for controls which have three motors running overcurrent protective devices, one in each phase.

When one primary of a delta-star or star-delta bank is open, the current in the secondary will be 115% of normal in two phases and 230% of normal in the other phase. The one with the 230% of normal could easily be the one without overcurrent protection.

The fine print note following section 4327 of the National Electrical Code states: "In the case of distribution systems supplying wye-delta or delta-wye connected transform-

ers (having the wye neutral point in the primary ungrounded or not connected to the circuit) the authority enforcing this code may require that three running overcurrent units be provided for the protection of 3-phase 3-wire motors, if field experience in the territory of the authority indicates that a third unit is desirable because of motor winding failures at times of primary single phase failures, unless the motors are otherwise adequately protected."—W.R.S.

**ANSWER TO D31**—In our small plants where we have relatively few machines we have found it very economical to install the third relay with heater protection in each magnetic. Most of the manufacturers have made provision for this to be added.

However, in our larger plants where we use automatic compensators and many machines, we have installed three relays on the secondary bus with each relay contact set in series with the holding coil of the main disconnect. We use the lighting circuit to energize this coil circuit with separate control, but the bus voltage can be used if preferred since when one phase opens that set of relay contacts opens and opens the main disconnect. Any opening of a phase in the primary would also affect the bus thereby opening one relay and the holding coil circuit.—C.S.S.

## Pressure Control For Pump Starter

**QUESTION E31**—*A one-hp, single phase, 220-volt, Lancaster submersible pump pumps water to a 1000-gallon storage tank about 2500 ft from the pump and about 75 ft higher than the pump house. At the present time, the pressure control at the tank, set for 60 lbs pressure, controls the magnetic starter at the pump house. This requires 5000 ft of outside wiring from tree to tree, which due to storms and other element hazards becomes torn down a few times each year, breaking the circuit.*

*Can a pressure control be put at the pump to control it and still*

*allow 60 lbs of water to be pumped to storage tank and eliminate outside wiring?—D.W.*

**ANSWER TO E31**—It would be quite feasible to reinstall the pressure cut-off device at the pump instead of at the tank. Assuming at the present that the cut-off device is located 75 feet below the level of where it cuts the pump off, we would recommend installing a pressure gauge at the discharge of the pump and start the pump allowing it to fill the tank until the pressure control cuts it off, reading the gauge continuously noticing when the control cuts the pump off. That would be your new set pressure if you relocated the controls back at the pump. The additional pressure increase from where the controls are located now and that at the pump would be caused by the resistance of the piping and fittings between the pump and the present location of the cut-off device. There must be considerable piping pressure drop now between the present cut-off device and the tank due to the fact that you say your controls are set at 60 pounds. A 75 ft. water head would only give you a setting of 32.5 pounds, in other words .433 pounds per foot in height of a water column, so it would be a simple matter to relocate these controls in the above described manner.—T.L.C.

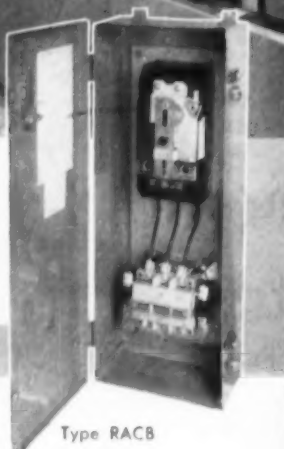
**ANSWER TO E31**—It is not too difficult to apply a pressure control at the pump and eliminate all outside wiring. You will need a lever-operated, quick acting gate valve on the filling pipe entering the tank, together with a float, sliding up and down on a tubular member, and operating the gate valve by suitable linkage. Your present pressure operated switch should be relocated to the pump.

The mode of operation is as follows: With the gate valve open and the pump operating, the water level in the tank rises until it reaches the shut-off point. At this point the rising float closes the quick acting gate valve. As the gate valve starts to close, the water pressure at the pump rapidly rises, and the pressure operated switch, set at 60 lbs., opens the holding coil circuit in the magnetic starter, and stops the



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Starters At The Connecticut By-Products  
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Type RACB

**PROBLEM:** To provide the best method of one-point control for electrically operated production equipment in a new plant . . . and to answer perplexing installation wiring questions.

*The Arrow-Hart Distributor, Beacon Light & Supply Company, Hartford, Conn., called for ARROW-HART SALES ENGINEERING SERVICE. THE NEAREST ARROW-HART SALES ENGINEER PROMPTLY WENT DIRECT TO THE JOB.*

**SOLUTION:** The A-H Sales Engineer analyzed the requirements and recommended Arrow-Hart Type RACB Combination Starters to save space and assure easy, fast installation and economical operation. Type TRA Reduced Voltage Starters were used to protect against line disturbances.

Equally effective on-the-job assistance is offered to all Arrow-Hart Distributors, Electrical Contractors and Plant Engineers confronted with perplexing problems. Simply write Dept. ECM, The Arrow-Hart & Hegeman Electric Company, 103 Hawthorn Street, Hartford 6, Connecticut, for complete information on ARROW-HART SALES ENGINEERING SERVICE.

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pump. By the time the pump stops the gate valve will be completely closed. If your pump does not already have an air chamber and check valve in the pump discharge line, these should be installed. When the water in the tank drops to the low point, the falling float opens the gate valve, with the result that the pressure falls in the pump discharge line, and the pressure switch closes, to start up the pump.

If the above arrangement short cycles, with too frequent starting and stopping of the pump, it indicates leakage at the gate valve or check valve, or possibly too small an air chamber on the discharge side of the pump. The air chamber can be a vertical length of pipe with a welded-on cap. The above device is in common use, and with proper adjustment, gives trouble-free service. —S.O.H.

### **Speed Characteristic Of Squirrel-Cage Motor**

**QUESTION F31—***Can a standard nine-lead 440-volt delta-connected squirrel cage motor be hooked up in such a way that it will run at half speed at 50% of its rated horsepower? What would the efficiency and power factor be at half speed?—M.D.*

**ANSWER TO F31—**No. Motors of this type are not of the variable speed type. Even if the voltage is reduced, the speed, as long as the machine is able to function, remains the same. The principle of operation is such that the rotor turns just below the speed of the rotating magnetic field, which is determined by the speed of the alternator driving. When the rotor slips below this speed due to a demand for more torque, currents in the rotor, induced by the cutting of the field, cause motor action and the rotor speeds up to a point of balance. The speed, therefore, depends on the frequency and the number of poles, neither of which is variable.

The nine lead motor is simply a dual voltage motor with part of its winding in series in one connection and in parallel in the other connection. —J.M.R.

**ANSWER TO F31—**The speed of a squirrel cage induction motor is given by the expression  $\text{rpm} = \text{frequency} \times 120$ , divided by the number of poles. From this expression it can be seen that if the speed of

the motor in question is to be changed, it will be necessary to change either the frequency or the number of poles. Since it is not feasible to change the frequency, the number of poles will have to be changed. In this case, to obtain half speed, the winding will have to be reconnected for twice the number of poles. However, this change will not affect the horsepower as the operating voltage and current would remain the same.

It might be possible to use a "consequent pole" connection, or so connected that the current produces the same polarity in all the pole-phase groups, instead of alternate north and south as in a standard connection. In this case the winding would be connected in parallel star for high speed and series star for the low speed. This grouping and reconnecting would give a constant torque and half the horsepower and speed when run on the series star connection.—G.L.L.

**ANSWER TO F31:** Although specially designed stator windings can be connected for and operated at several different speeds, squirrel cage induction motors are primarily constant speed motors. The number of poles and line frequency determine the speed which equals  $120 \times$  frequency divided by number of poles. Neither speed nor torque of such a motor can be influenced by external load connections. Its speed is, by design, a function of load and torque, neither of which can be varied from basic design characteristics after the motor has been built. Therefore, except for pole-changing or other specially designed motors, such as those with two or four separate windings or with facilities for changing from delta to star, it is unwise to attempt the suggested change, at least without consulting the motor manufacturer.—W.R.S.

### Torque and HP Motor Ratings

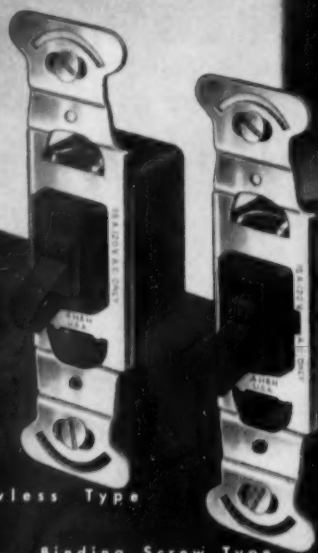
**QUESTION G31**—*Recently I connected 3-phase, 240-volt motors with the terms "constant torque" and "variable torque" marked on the 2-speed drum switches used.*

*The machinist in charge of the job told me they also have constant horsepower motors. Will you please explain the terms and also some application for their use.*—V.S.

**ANSWER TO G31**—Multispeed in-

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in size . . .

**BIGGEST**  
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Screwless Type

Binding Screw Type

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The facts and features speak for themselves! Small size for more wiring room, a choice of *Binding Screw* or *Screwless Wire-Lock Terminals*, silver alloy contacts, and noiseless operation!

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duction motors are classed by their torque characteristics.

Constant hp motors produce the same hp at all speeds. They are used for machine tools where the torque demand decreases as the speed increases.

Constant torque motors produce the same torque at all speeds and the hp is in direct proportion to the speed. These motors are used for conveyors, stokers etc.

Variable torque motors produce a torque that decreases with the speed resulting in a hp output which decreases as the square of the speed. Such motors are principally used for fans.

In each case the above characteristics match more or less the requirements of the load, hence their choice.

These inherent motor characteristics or relationships can better be visualized if you remember that: hp is proportional to the product of torque and speed, which is derived from the formulae  $hp = T \text{ times } S/5250$ .

You want to be aware that the stator may have either one or two windings, each of which will produce either one or two of the desired speeds. Where two speeds are desired—one half the other—we use one winding and it is called a consequent pole motor. Where the two speeds desired are not in the ratio of 2:1 two windings must be used. A combination of the above will make possible three or four speeds. Pole changing is accomplished by an external pole changing switch.—E.M.

ANSWER TO G31—The designations variable torque, constant torque and constant horsepower apply to multi-speed motors.

The hp of a variable speed motor varies as the square of the speed. In other words if a two-speed motor is rated at 10 hp at 1800 rpm on the high speed, it will have a  $2\frac{1}{2}$ -hp rating at 900 rpm.

Motors of this type are used on loads that vary as the square or cube of the speed such as fans, centrifugal pumps and the like.

The hp output of motors of the constant-torque type varies directly as the speed. A ten-hp motor connected to run at 1800 rpm will have a rating of 5 hp at 900 rpm.

These are machine-duty motors where the current remains practically constant throughout the entire speed range, used to drive refrigeration compressors, air compressors, reciprocating and displacement pumps, etc.—B.A.S.



## Can You ANSWER These QUESTIONS?

**QUESTION Q31**—I would like some help in regard to the use of small (150-amp) ac resistance welders that are now in very common use. The use in question is in residential areas.

There is considerable interference in radios and televisions. This does not seem to be caused so much from the arc made in welding but from the surge on the line which is evidently causing a feed-back to the power company lines. However, this is not so strong when connecting the welder for 220 volts. I am wondering if some reader has had success with a choke coil, reactor or anything that could be made or purchased to eliminate this interference.—C.S.S.

**QUESTION R31**—In using a 20 megohmmeter with a 7½-volt battery would this meter be proper for testing 440-volt circuits for insulation test, or would I have to use a Megger of much higher voltage? Is it correct to test any circuit with twice the voltage of its nominal operating voltage?—V.S.

**QUESTION S31**—How could it be definitely determined if an installed cable could be used safely on a much higher voltage without removing the cable or damaging it in any way?—E.B.

**QUESTION T31**—Where may accurate information be obtained concerning ac and dc current-carrying capacity of steel conductors (rails, angle iron, channel iron, beams) used along runways for overhead traveling cranes? In one large industrial plant, an ac density of 125 amps per square inch for all sizes was specified, but neither ambient temperature, temperature rise, or type of steel conductor was mentioned. It seems that the value of current density would be lower in the case of, say, a 50-lb rail than, for example, of a 2-in. by 2-in. by ½-in. angle iron due to greater hysteresis and eddy losses in the former. Have any tables of current-carrying capacity of various sizes of steel conductors been published?—O.A.

PLEASE SEND IN  
YOUR ANSWERS BY FEBRUARY 15



types

W. G. WELDING, CONTROL CABLES  
50, 510, 5V-NEOPRENE CORDS  
50 & W SHIELDED CORDS AND CABLES  
CORDS & CABLES MADE ESPECIALLY FOR  
USE ON PAYOUT & RETRACTABLE REELS

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AND BIG CABLES IN LENGTHS  
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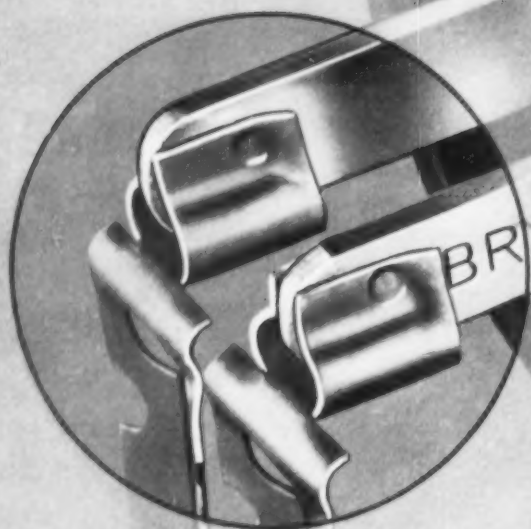
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## Better Contact...Longer Wear...Easier Installation



The redesigned Bryant 6142 Outlet eliminates loose-fitting cap blades. New floating, double-sided contacts grip cap blades securely at all times, even when cap is inserted or removed at angle. Insertion of wire in terminal spring grip does not spread contacts. Integral snap lock buttons hold cap blades securely, reduce contact wear.

### Plus BRYANT Installation Time-Savers

Captive mounting screws speed installation.

Spring grip terminals speed wiring. Simply insert stripped end of conductor in hole and connection is completed. Wire strip gage.

### Plus These BRYANT Quality Features

Compact body design allows more wiring space inside box.

Safety construction . . . no exposed current-carrying parts.

Stronger, straight-through yoke with scored plaster ears.

Rated 15 amperes, 125 volts.

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Inc.

# Questions on the Code

Answered by

**B. A. McDONALD**, New York Board of Fire Underwriters, Rochester, N. Y.  
**GLENN ROWELL**, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.  
**B. Z. SEGALL**, Consulting Electrical Engineer, New Orleans, La.

## Voltage Drop

**Q.** I would appreciate your answer to the much-discussed problem of voltage drop as permitted by the National Electrical Code.

1—May the voltage drop of a 3-wire 208-volt, single-phase circuit (consisting of 2—120-volt circuits) be calculated at 208 volts?

2—May the voltage drop of a 4-wire, 208-volt, 3-phase circuit (consisting of 3—120-volt single phase circuits) be calculated at 208 volts, 3-phase?

Please refer to the sketch below for the purpose of illustration.—H.P.C.

**A.** It is my opinion that the voltage drop of the 3-phase, 4-wire, 120/208-volt, wye circuit in question should be figured under conditions of maximum unbalance. This occurs when only one phase of the circuit is in operation. In other words all calculations should be based on 120 volts. Since I am unable to find where the Code specifically covers this question, the opinion is personal.

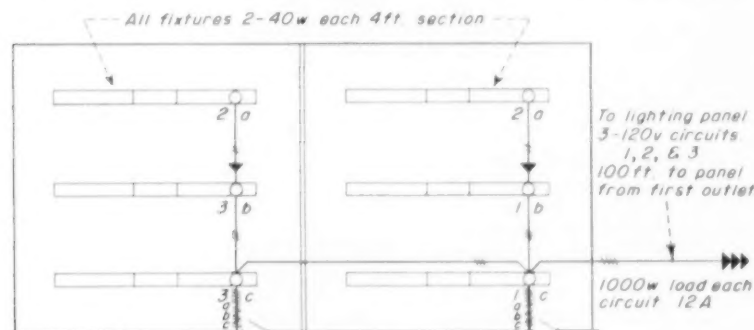
It is evident from your wiring diagram that all phase conductors

of the circuit, when fully loaded will carry a current of 10 amps for 100 ft. At this point 50% of the load on circuit No. 1 terminates and the other 50% extends a short distance. Circuits No. 2 and No. 3 extend a considerable distance beyond the first 100 ft but the load decreases with the length of the circuit. As a result we have a condition where parts of each circuit carry only 5 amps. This factor may be recognized and the wire size reduced accordingly, within the limitations of a 20-amp branch circuit, which requires a minimum No. 12 conductor. The rating of the branch circuit is determined by the overcurrent device.

The Code does not recognize any demand factor other than 100% to be applied to the neutral conductor of a branch circuit, since the maximum condition of unbalance load would cause the neutral to carry the same current as the phase conductor. It is also important to note that when two phases only are in use and they are fully and equally loaded the neutral will carry the same current as the 2 phase conductors. Section 2203-g of the Code recognizes a 70% demand for feeders on that portion of

the unbalanced load in excess of 200 amps. If however the feeder load consists of 50% or more of electric discharge lamp ballast, there shall be no reduction in the size of the neutral conductor below the size of the phase conductors. This is a new 1956 Code provision which resulted from field experience that indicated a 3-phase, 4-wire circuit serving single phase fluorescent ballast loads produced neutral currents approximating the phase current due to third harmonics developed by the ballasts.

It should also be noted that the voltage drop provisions of Section 2202 are in the nature of a recommendation and apply only to feeders, and not branch circuits. There are many who contend that the Code should have a mandatory provision concerning voltage drop and the example you have presented verifies such an opinion. The Code requirements however are minimum and it becomes the responsibility of the wiring design engineer to see that factors concerning the efficient and effective use of materials and devices are fully realized.—B.A.McD.



Questions—1. If this wire size be No. 10, 8, 6 or 4 TW may the continuation be No. 12 TW?  
 2. May the neutral conductor be of smaller size than phase conductors?

Voltage drop calculations, 90% P.F. 120v 1 Ø

Circuit No. 1, 10A 120v for 130ft. = 0.95% volts drop (No. 6 TW)

Circuit No. 2, 10A 120v for 150ft. = 0.70% volts drop (No. 4 TW)

Circuit No. 3, 10A 120v for 160ft. = 0.75% volts drop (No. 4 TW)

Question May the voltage drop be calculated to the first outlet at 208v 1 Ø or 208v 3 Ø as follows:

Circuit No. 1 & 2 10A 208v 1 Ø for 100ft. = 1.0% V.D. (No. 8 TW)

Circuit No. 1, 2 & 3 9.3A, 208v 3 Ø for 100ft. = 0.9% V.D. (No. 10 TW)

Branch circuit breakers 20A 1 pole

## Disconnecting Switch

**Q.** Where a building is served at 13,800 volts, is it necessary for the disconnecting switch mounted in the incoming service conductors to disconnect or interrupt the service under load conditions?—C.M.

**A.** In paragraph 4, following Section 2389 you will note that if the voltage is 15,000 or less, a switch capable of interrupting the no-load current of the transformer and suitable fuses may be used provided the switch is interlocked with a circuit breaker in the secondary circuit of the transformer so that the switch cannot be opened when the circuit breaker is closed. If this interlock does not exist, then the switch would have to be capable of interrupting the current under load conditions.—G.R.



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**JOB:** Penetrate 3½" concrete cap over cellular steel flooring for 2½" dia. electrical outlets at Ford Motor Company's new Administration Building. 8,400 holes required to bring in electrical, telephone and inter-com wiring for offices.

**CONTRACTOR:** Harlan Electric Company, Detroit

**TOOLS:** Truco Diamond Drilling Machine equipped with 750 RPM Motor and 2½" O. D. Truco Diamond Drill Bits. (Machine was also used for horizontal drilling.)

**DESCRIPTION:** Spotting crews located outlets and cut the rubber floor tile with a circular saw. Portable rubber-tired Truco Diamond Drilling Machine then drilled through concrete in 90 seconds per hole. Complete cores were lifted out leaving smooth, perfect holes, requiring no patching or finishing. Finished floor undamaged by drilling operation.

Picture shows Truco vacuum water pick-up removing cuttings and coolant water as Truco unit is drilling. Because Truco is dust-free and relatively quiet, drilling was done in occupied sections of the building without disturbing tenants.

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## Service Entrance Conductors in Parallel

**Q.** For a 600-amp service there are being installed three service conduits with four wires in each, same size, fed from same transformer and terminating in one 600-amp switch.

These wires are thus being paralleled in separate raceways. I have said this is not permitted; if in multiple they shall all be in the same raceway. Am I right or wrong? I don't know how it is possible to get these wires the same length.—L.S.C.

**A.** Section 3105 intends to limit the sizes which may be paralleled but does not intend that they all be included in one raceway, conduit, etc.

From your description I take it that it is planned to install three conduits with a capacity of 200 amps in each. If they use Type R wire they would most probably use 250 mcm wire, and if Type RH is installed then 3/0 could be used. Both of these sizes are larger than 1/0, the smallest size permitted to be used for parallel operation.

Look at this problem in another light. Suppose you were going to have a 2000-amp service. If you used 600 mcm Type RH conductors you would have a capacity of 420 amps per conductor. For this total capacity you would need at least five sets of conductors or a total of 20 conductors for a 4-wire service. The Code at present only permits nine wires in a conduit so you would have to have at least three sets of conduits for this service.

It is quite possible to get wires of approximately the same length, even though they will be placed in separate conduits. After all a slight variation in length will not cause as much trouble, considering current distribution, as will careless terminations of the cables at each end of their run.—B.Z.S.

## Neutral Conductor

**Q.** Is there any rule in the Code which would prohibit the use of a No. 6 conductor as the neutral on a 3-wire service if the ungrounded conductors were No. 2? I have been told that the neutral must be within two sizes of the ungrounded wires, yet I can see no reason for this inasmuch as the maximum 115-volt load in the



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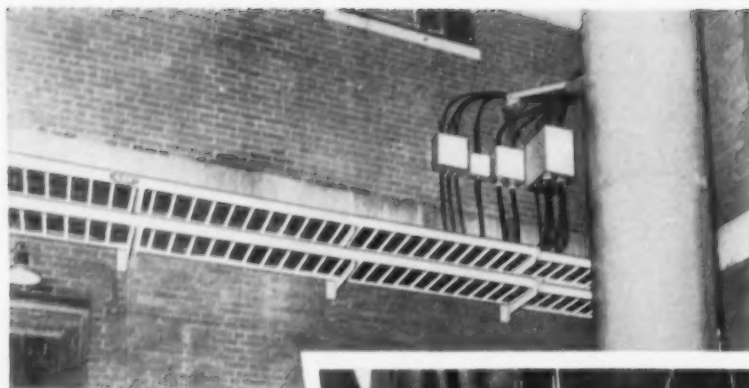
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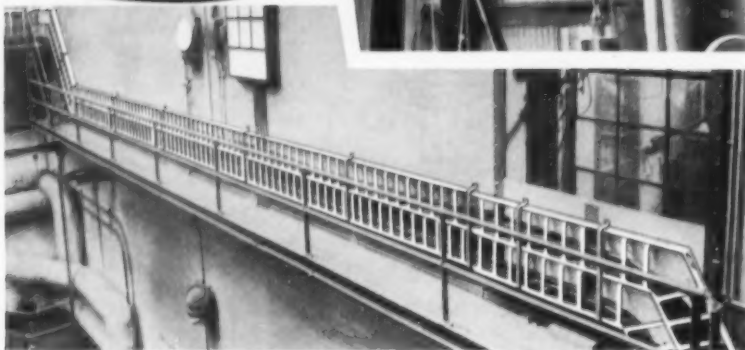
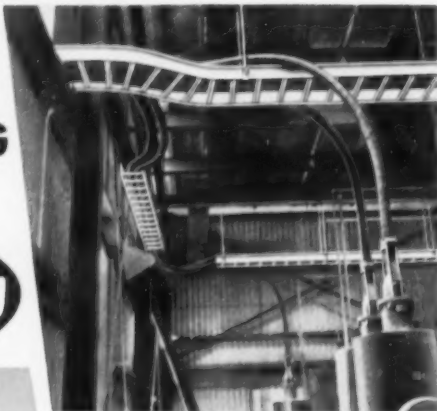
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building in question on either leg could not exceed 40 amps.—G.M.P.

**A.** Under Section 2304 of the National Electrical Code, you will find the following: "The neutral conductor (which) shall have a current-carrying capacity in conformity with section 2203-g, but shall not be smaller than the ungrounded conductors when these are No. 8 or smaller."

Then under paragraph g. of Section 2203 you will find that the neutral feeder load shall be the maximum unbalance of the load as determined by Section 2203. The maximum unbalanced load shall be the maximum connected load between the neutral and any one ungrounded conductor. Therefore, if the maximum connected load on the installation in question between any one ungrounded conductor and the neutral does not exceed the carrying capacity of a No. 6 conductor, that conductor may be used for the neutral even though a No. 2 or larger conductor is necessary for the ungrounded conductors supplying this building.—G.R.

### Busway—Small Neutral

**Q.** Is the use of 3-phase, 4-wire feeder duct with 50% neutral a violation of the Code? In article 364 covering busways no mention is made of a reduced neutral. The only section which I can find that would permit some reduction in neutral is Section 2203-g which permits a neutral of reduced size only over 200 amps and then the factor is only 70% plus the 200 amps, which definitely would not allow a 50% size. It seems as though most of the duct manufacturers make this 50% neutral duct, however its use would seem to be a violation of the Code. With respect to the above it is assumed that the load will be between phase and neutral. (Maximum unbalance will be same as load on one phase.)—F.D.

**A.** As you state, Section 2203-g of the Code recognizes a 70% demand factor to be applied to the neutral conductor of a 3-phase, 4-wire feeder, on that portion of the unbalanced load in excess of 200 amps. The 1956 Code amended this provision, when a feeder supplies loads which consist of 50% or more of electric discharge lamp ballasts, so that the



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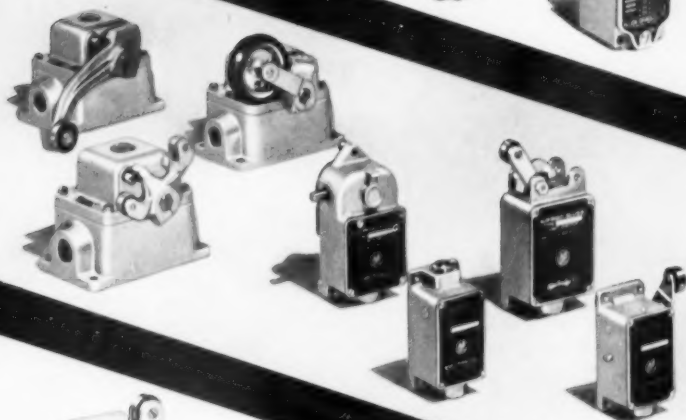
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size of the neutral will be the same as the phase conductors. This Code revision recognizes field experiences which indicates that single phase ballast loads, connected between the neutral and phase conductors of a 3-phase, 4-wire Wye system, produce neutral currents due to third harmonics developed by such a combination.

I personally believe that the practice of manufacturing busway with a 50% neutral bus, is influenced by the combination of loads generally served. On an installation where 50% of the load, such as motors, operate at 208 volts the neutral is not concerned and there would be no Code violation involved. When the total load served operates at 120 volts the neutral must be able to serve the maximum unbalanced load which would result in a capacity equal to the phase capacity, and when such loads are ballasts, as covered above, no demand over 200 amps is recognized.—B.A.McD.

## Water Pipe

**Q.** Can water pipe be used in place of conduit, anywhere, anytime?—T.S.

**A.** No! Water pipe is not conduit. It does not have the finishes approved for use with electrical conductors.

As a protection means, i.e., protecting cables, etc., from mechanical injury, it has some application. It is also approved as a grounding conductor (see Sections 2594b and 2595). It is definitely not approved as a raceway for electrical conductors.—B.Z.S.

## Bare Conductor

**Q.** Where in the National Electrical Code will one find any rule which says that one cannot use a bare copper conductor as the neutral for a buried circuit?—J.M.

**A.** Under Section 1110 of Article 110 you will find the following wording: "Unless approved for the purpose, no conductors or equipment shall be located in damp or wet location; where exposed to gases, fumes, vapors, liquids or other agents having a deteriorating effect on the conductors or equipment; nor where exposed to excessive temperatures."

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matter or some other chemical which is injurious to copper, the use of a bare conductor as part of an underground circuit would be in violation of this section unless an analytical test of the soils in which this bare copper conductor was buried indicated that soil was free of any deteriorating agencies. It is true that in certain types of locations bare copper conductors will not be affected by soil acids or alkalis. The most common instance where this is true is on street lighting circuits contained wholly under paving or sidewalks where the soil consists largely of sand or very light loams. Experience on airport lighting has indicated the serious necessity of not using bare copper conductors until such times as an analytical test of soil proves it safe as there are actually instances where conductors have been eaten through in less than two years' time.—G.R.

### Unequal Current— 3-Phase Motors

**Q.** Thermal overloads trip more readily during the summer months when motors are drawing less than nameplate current rating. We also note that most 3-phase motors do not draw the same current per phase. Example, 10.5, 9.7 and 11.1 amps per A, B and C phases. The line voltage is balanced within a volt or two. As a result of the unbalanced currents needless tripping of overload devices occur, yet motors seem to be O.K. Your comments will be appreciated.—P.P.G.

**A.** In answer to your first question a thermal overload device will operate more readily during the summer months when the ambient temperature is high. Section 2403-c of the Code recognizes the effect of ambient temperatures on the operation of thermally controlled circuit breakers and recommends that this factor should be considered when breakers are subjected to extremely low or high temperatures. Manufacturers also recognize this factor and breakers may be obtained that automatically compensate for variable ambient temperatures, or are arranged to be set as the occasion may require. In connection with heater coils used in conjunction with motor controllers the General Electric Company advises that all Trumbull heaters and relays are based on a



40 degree centigrade ambient and such devices will carry approximately 1% more current for each degree C less than 40 degrees ambient, and 1% less current for each degree C more than 40 degrees centigrade.

In answer to your second question unequal currents in the phase wires of a 3-phase motor branch circuit could be due to unequal voltages over the phase conductors. When single phase loads are not equally balanced over the phases such reduced voltage could result. Possibly poor connections in the motor circuit also would promote a reduced voltage at the motor terminal. Three-phase motors also tend to correct variable voltages over the phases. It appears however that phase voltage is not involved in view of the small 2-volt variation. Assuming that the motor running overcurrent devices are rated 125% of the nameplate current rating of the motor, it appears to me that the motors are overloaded under normal operation and this factor may be more significant than the small variation in phase currents. It appears obvious that a motor operating at full load, even though there is a slight variation in phase current, would not cause an over-current device set at 125% of full load, to operate. This factor coupled with high ambient temperatures may be the cause of the unusual interruptions.—B.A.McD.

### **RH-RW Services— Current Carrying Capacity**

**Q.** In the October issue of your magazine, you expressed the opinion that a No. 3 RH-RW conductor installed in a conduit or tubing exposed to the weather, as service entrance conductors, would have a current carrying capacity of 80 amps which corresponds with its RW insulation. Would this opinion apply equally to service entrance cables exposed to the weather that have RH-RW insulation? Enclosed is a clipping from an advertisement taken from the September issue of E.C.&M. which indicates that a No. 3 RH-RW service entrance cable, exposed to the weather has a current carrying capacity of 100 amps. Does this conflict with the N. E. Code?—C.R.A.

**A.** My answer to the original question was based on a literal reading of Section 3102-b of



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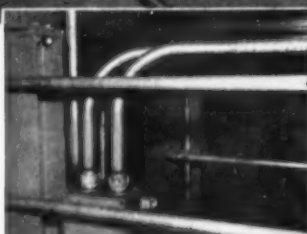


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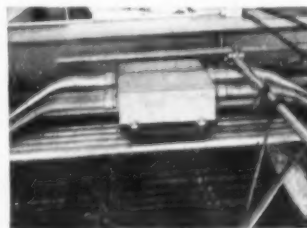
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the Code which requires RW, TW, MI or lead covered conductors when such types of insulations are used in a wet location; and the definition of a wet location, Article 100, which includes locations exposed to the weather. I also questioned the use of the term "exposed to the weather" as inappropriate since the word "weather" as defined covers the state of the atmosphere with respect to cold, heat, wet, dryness, humidity, etc.

According to the 1956 edition of the Code a No. 3 RH-RW insulated conductor used in a dry location has a current carrying capacity of 100 amps, and in a dry or wet location 80 amps. A literal reading of the above Code rules indicates that a service cable or a service raceway is usually exposed to the weather and the conductors enclosed are to varying degrees so exposed. I do not believe however that this literal reading expresses the correct intent since we have, for many years, been accepting ordinary "R" insulation in a service raceway or cable with little thought of requiring RW, TW insulations or a lead sheath. Years ago however I do recall where lead covered conductors were required to be installed in service risers by some inspection authorities.

In order to clarify the intent of this rule, I consulted Mr. Sam Rosch, who is a member of Panel No. 6, Electrical Section, NFPA and the outstanding authority on matters concerning conductors, their insulation and other characteristics. Mr. Rosch through a two-page letter advised, in part, as follows:

1.—Neither the writer nor the Code authorities dealing with this particular subject have ever considered that the conditions surrounding an installation of types SE or SD cables, are of the type that might be classified as "wet location." To fall under the latter heading, it would be necessary for the wiring material to rest on or in a medium where water might collect and continue to remain as such for some period of time. By no stretch of the imagination, would that be considered true in the case of a service drop suspended horizontally between a pole and the point of attachment to a building, or in the case of an SE cable originating in a service or weatherhead and running vertically down the side of a building.

2.—It is true that the outer covering, fibrous or even of an extruded nature, may become wet



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Business \_\_\_\_\_

I am in charge of electrical work ☐ Yes ☐ No

Person in charge  
of electrical work is \_\_\_\_\_

Operate a motor repair shop?

☐ Yes ☐ No

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either as the result of a pelting rain or the continued presence of snow or sleet. To guard against this, U/L requires the presence of an outer covering containing a moisture seal and has specified a definite type of test condition to prove the integrity of such seal. It is for that reason that the standard types of SE cables are not required to be made with moisture-resistant types of insulation. However, where a manufacturer elects to use an approved-type of moisture-resistant insulation on the individual ungrounded conductors of such type SE cable, he may dispense with the special moisture seal generally incorporated in the overall outer covering of type SE.

3.—A type SE cable may not be installed directly in the ground or in any place which can be considered as a wet location unless the conductor insulation is of an approved moisture-resistant type and is so identified on the cable. However, where a manufacturer uses a type of insulation which has a rating of 60C in wet locations but 75C in dry, there is nothing to prevent such manufacturer from rating such insulation in type SE cable with the 75C values because such installation is definitely not considered a wet location. It is for that reason that a number of manufacturers have furnished type SE cable in size No. 3 AWG, insulated with RH-RW compound, and rated same at 100 amps. The same is true where such ratings are under the jurisdiction of the local utilities."

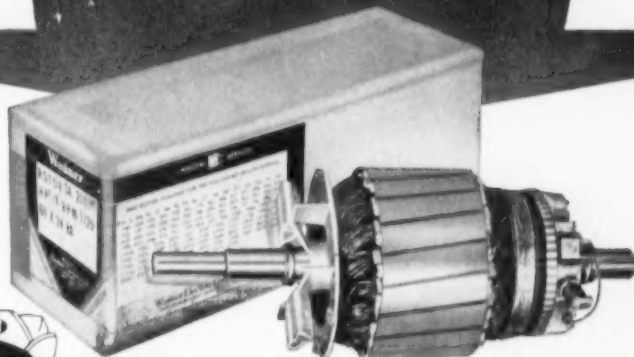
The foregoing comment clarifies the status of SE cable with a background of reliable authority and while I agree, it appears to me that the Code should clarify the definition of a "wet location" so that there would be no question with respect to the term "exposed to the weather."

Insofar as rigid conduit or tubing is concerned, the same reasoning applies provided the raceways are so arranged or drained that moisture will not accumulate within the conduit. This opinion also was verified by Mr. Rosch and others who attended the recent meeting of the Eastern Section, IAEL.

A summary of the foregoing indicates that existing Code provisions intend to recognize a No. 3 RH-RW conductor installed either in a conduit, or in the form of a raceway, as qualifying for a 100-amp rating. As Sam says, "It is possible that the matter might be

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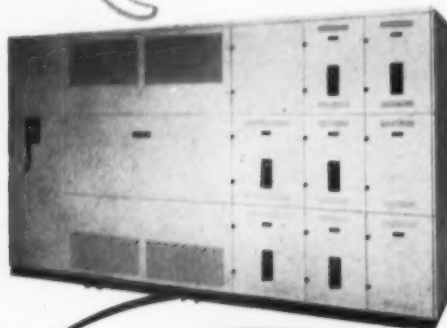
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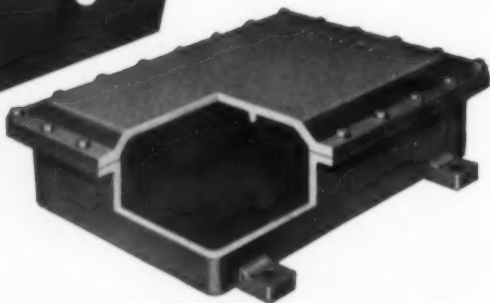
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spelled out more thoroughly by some appropriate modifications or additions to the service cable provisions in the Code." The matter has been called to the attention of Frank Stetka, Chairman of Panel No. 6 and possibly some action along these lines will be taken in the future.—B.A.McD.

## Clearance Over Roof

**Q.** In Section 2322 is it the intent of this section to maintain a clearance of 8 ft over all flat roofs or does it mean only roofs which are readily accessible by permanent ladders or stairs?—C.L.T.

**A.** The question of whether or not a permanent stair or a permanent ladder is provided to give ready access to the roof does not enter into the problem. Interpretation No. 400 had definitely given the Code intent.

Basically the intent is to require the 8-ft minimum clearance if the roof can be readily walked on regardless of how access to the roof has been obtained. If it takes a portable ladder or a hoist to get to the roof does not in any way involve itself in the answer to the question as to whether or not you can readily walk on the roof once you have gotten on it.

A flat roof in general, is certainly readily walked on once you have reached it. Just how much slope you must have before you can say that the roof is not readily walked on will depend a great deal on the material used for the roof and the general construction of the roof.—B.Z.S.

## Emergency Lighting

**Q.** This question concerns the overcurrent protection for emergency and exit light systems. On most installations in this area the emergency and exit light supply is tapped off ahead of the main disconnect then run to a separate main disconnect for the emergency and exit light system then to a fused branch circuit panel that is exclusively for the exit and emergency lighting. Inasmuch as the NEC does not require exit and emergency lighting systems but only sets up standards which may be enforced by the authorities having jurisdiction in the local areas, I would like to know if there is any such standard that calls for fused circuits in the emergency

panel. I have observed that on most installations, fused circuits are used for the emergency branch circuits even though circuit breakers are used in the lighting panels in the rest of the building. If this is not a part of the standards, I would like to know the reason for this and if any safety feature is obtained by using fused circuits.—F.D.

**A.** I do not know of any Code requirement which makes any distinction between the use of a fuse or a circuit breaker when used to protect emergency or exit circuits, and I do not know of any other generally recognized standard which makes such a distinction. The important role played by emergency lighting warrants any design which will eliminate the needless operation of overcurrent devices during an emergency and in my opinion such an objective may be attained by the use of fuses or circuit breakers. Many years ago, as covered by the 1933 edition of the Code, Section 4107, the term "fuse" was used when speaking of overcurrent devices, and it is quite possible that the field installations you have observed stem from an erroneous conclusion that circuit breakers were not recognized. The 1933 edition of Abbott's Code Handbook contains the following remarks on this subject:

"The rule as it appears in the Code (1933) mentions fuses only, however, it is obvious that the requirements should apply to circuit breakers also, and it may be stated on good authority that it is the intention that the requirements should be so applied."—B.A.McD.

### Parallel Conductors For the Neutral

**Q.** Is it the intent of the rule in 3105 to permit conductors smaller than 1/0 for the parallel conductors to be run for the neutral which will carry the unbalanced neutral load?—W.H.J.

**A.** No! The only exception for conductors smaller than No. 1/0 is given for elevator circuits in Section 6205a1.

In other words this would mean that a No. 1/0 would have to be used even though the unbalanced neutral current for several conductors would require a conductor size smaller than this.—B.Z.S.



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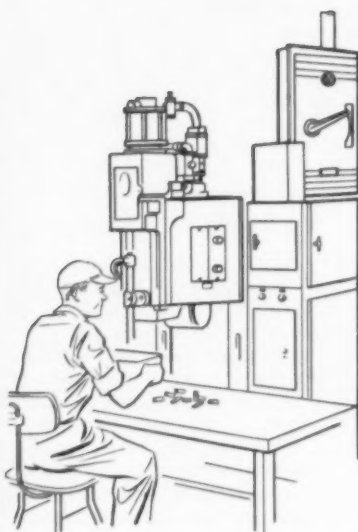
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# Practical Methods

## Bank Ceiling Provides Light, Sound and Air Conditioning

LIGHTING

The Carter Electrical Construction Company of Pittsburgh installed a real prize-winning lighting job when they made the luminous ceiling lighting installation in the First National Bank in McKeesport, Pa., shown in the accompanying photos. This installation won the \$75 first prize in a Planned Lighting Competition sponsored by the Electric League of Western Pennsylvania.

This new lighting system provides illumination, sound control, and air diffusion for the cooling system. It consists of 36-in. wide strips of corrugated vinyl plastic installed side-by-side over the tellers' cages and extending from the rear walls out over the customers' deal plates, suspended down from the old plaster ceiling above, plus continuous rows of wiring strips, fluorescent lamps, ballasts, etc., complete with T-bars and sound baffles. The sound baffles are attached to the bottom of the T-bars. The wiring strips are supported about 12 in. from the old plaster ceiling by metal straps, and the T-bars are suspended from the plaster ceiling by galvanized wire. All pipes, straps, etc., and air ducts, including the air outlets, are concealed in the plenum by the corrugated plastic panels. Air from the air conditioning outlets is forced into the plenum, and is then diffused into the banking area below by leakage through the space which exists where the corrugated plastic panels rest on the T-bars.

The new lighting system not only produces an ideal visual environment, but also provides a good looking banking interior.

This lighting arrangement was part of a remodeling job in the First National Bank, and was designed by William H. Young, architect. The Mellon-Stuart Co., of Pittsburgh was general contractor. Carter Electrical Construction Co. cooperated in the design of the lighting system and performed all the electrical work including the installation of the lighting. Luminous Ceilings, Inc. supplied the Acusti-Luminous ceiling.



**LUMINOUS CEILING** provides comfortable and glare-free lighting in main banking area of First National Bank in McKeesport, Pa. Baffles under ceiling absorb sound and shield plastic panels.



**PLENUM** contains fluorescent lamps and wiring strips suspended from ceiling on metal straps, also air duct and air outlets (far right). Air diffuses through ceiling to cool banking area below uniformly and evenly.

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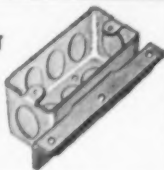
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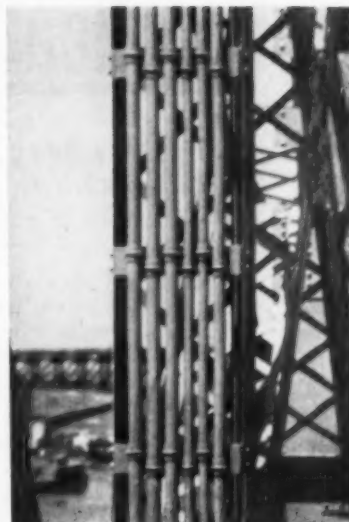
## Staggered Clamps and Grommets Hold Closely- Spaced Risers

### DISTRIBUTION

When Lightning Electric Service  
Company of Newark, N. J., installed  
the wiring for a hefty vertical-lift  
bridge across the Hackensack  
River, they encountered several  
problems related to space limitations,  
materials handling, submarine  
cabling and placement of  
equipment in bridge-tower penthouses.  
Many of these problems  
were solved by devising methods or  
adapting equipment for specific  
purposes on the jobsite.

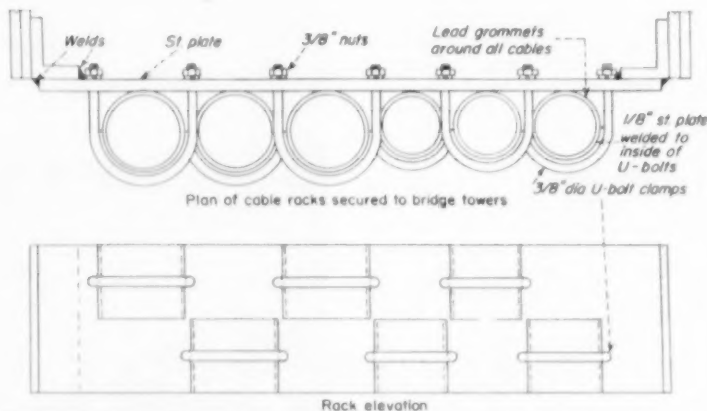
One such method concerned the  
supporting of vertical cables that  
connected the switchgear room, operator's  
control station and underbridge utility  
vault with the elevated motor penthouses.  
The problem developed because six  
cables had to be mounted against the  
web of one column of the bridge's  
superstructure. The width of the  
column web therefore dictated the  
permissible width for placing the  
cables but, if supporting U-bolts  
were placed at the same elevation  
side by side, the combined overall  
distance of cables plus bolts would  
be greater than the width of web.  
It was also considered advisable to  
weld a 1/8-in. steel plate to the inside  
of each U-bolt in order to increase  
the bearing surface of bolt against  
cable. And, for additional protection,  
it was decided to also place  
1/8-in. lead grommets around cables  
at all support points. Thickness of  
grommets and plates would further  
increase the overall reach of the  
six cables.

The solution decided upon was

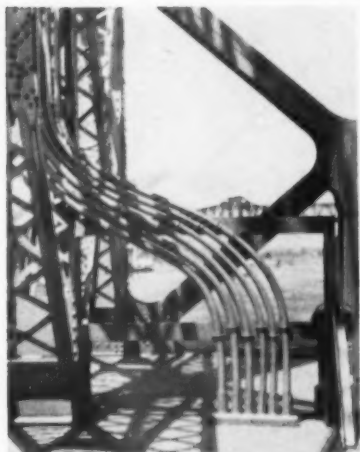


**VERTICAL CABLE RISERS** are carried to  
motor penthouses atop bridge along lattice-  
braced supporting column. Combined  
diameters of cables, plus combined  
widths of supporting U-bolts made it  
impossible to position clamps at same  
elevation, so staggered arrangement was  
decided upon.

to locate a 6-in.-wide 26-in.-long  
1/8-in.-thick steel plate at each support  
point, securing it to angle  
braces by welds, and securing the  
angles to column flanges by bolts.  
This plate was then drilled so that  
the 1/8-in. U-bolts would be staggered  
along two elevations 3 in.  
apart. This staggering resulted in  
placing the outside of each bolt in  
vertical alignment with the inside  
of the grommet surrounding the  
adjacent cable, and it permitted  
the close-spaced arrangement of  
all six cables within the limited  
mounting width. This arrangement  
made it possible to contain over 200



**PROTECTION FOR CABLES** at all clamping points was obtained by welding steel  
plates to inside of U-bolts, then surrounding cables with lead grommets. Bolt holes  
were staggered so that outside of each bolt is in vertical alignment with inside of  
lead grommet surrounding cable in adjacent bolt.



**CABLES EMERGE FROM TOP** of switchgear room via weatherproof collars and shields, then are offset to column line for ascent to motor penthouse. Braced angle-and-channel framework provides intermediate supporting means for cables, with U-bolts installed at inclination to embrace the slanting cables at this point.

conductors in this compact order, for three of the cables were 66/c No. 10s, two were 6/c No. 1/0s and the sixth cable was a 3/c 350MCM.

## Outdoor Stadium Heated by Electricity

### HEATING

"Heating the whole outdoors", a phrase used lightly in connection with many a poorly insulated heating installation, came closest to being a fact last winter when electric heaters were used to warm 4000 spectators at the outdoor Olympic Stadium in Cortina, Italy.

Sub-zero temperatures are not uncommon in Cortina, scene of last winter's Olympic Games, making it uncomfortable for sports fans sitting in the open for hours at a time. Stadium officials decided to experiment with heating, and the N. J. Thermex Co. Inc., of Harrison, N. J., was contracted to engineer the installation.

Specifications required warming of the feet, legs and hands of the spectators, regardless of the temperature, in a given area of the stadium having a seating capacity of approximately 4000.

Company engineers determined that the amount of heating capacity required per person would be between 200 and 250 watts, depending upon the ambient temperature. Realizing that radiant heat would be least affected by winds and air currents, they adopted Infralite

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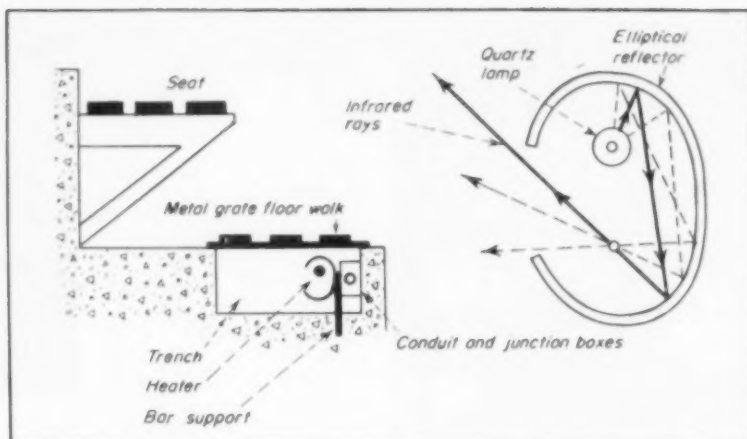
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**RADIANT HEATERS**, installed in trenches in front of seats, warmed the feet, legs and hands of spectators at the Olympic Stadium in Cortina, Italy, during the 1956 winter Olympics. Enlarged section of reflector (right) shows how infrared rays from quartz lamp were reflected through aperture and outward toward spectator.

radiant heaters for the job, incorporating a quartz heating element in a 6-ft-long elliptical reflector. Design of the fixture was such that, with the element mounted at the upper focal point of the elliptical section, infrared rays would be reflected through the lower focal point and out to heat the spectators.

Fixtures were mounted using vertical steel bars in trenches in the concrete floor immediately in front of the spectators' seats. To protect the heaters from injury from falling objects, canes, etc., a grate-like metal floor was constructed over the trench. Heat reached the spectators by direct radiation through the flood bars with-

out heating the intervening air. In addition, heat was absorbed by the bars, keeping the feet warm. Heaters, rated at 1000 watts each and operated at 380 volts, were wired using grounded rigid metallic conduit throughout.

The installation was successful. Cost for each event at which the heaters were used totalled 1½ cents per hour per customer. At the lower electrical rates prevalent in the United States, it is estimated that comparable installations here would cost approximately ½ cent per person. Since this is a negligible addition to the ticket price for most sporting events, such installations raise interesting possibilities for comfort-conscious sport fans.

## Lighting and Display Sells Shoes

### LIGHTING

Display of merchandise for maximum consumer appeal is one of the major factors relied upon by the modern retail store for building up and maintaining a profitable sales volume. And proper lighting is the key to effective display.

Recognizing these facts, Kushin's Shoe Store at Walnut Creek, Calif. has used a variety of lighting units and techniques to create a beautifully illuminated interior with highly effective displays, which feature the footwear, ladies handbags and other feminine accessories in a most appealing and attractive light.

General illumination is provided by recessed fluorescent modular units. This is supplemented by perimeter fluorescent cove lighting, and by suspended indirect incandescent luminaires having a shallow

opaque bowl. This supplementary lighting adds a cheerful decorative touch by lighting the ceiling softly, and by combining incandescent and fluorescent light for a warmer effect than would obtain with fluorescent light only.

Incandescent reflector spot lights are used in ceiling-recessed adjustable units, and in wall bracket-mounted bullet-type units, to provide spotlight accents on merchandise displays.

A general effect of clean and shadowless high-level illumination is the result, with an overhead aura of sky-light clarity. The overall tone of diffused illumination from the fluorescent units is made interesting with the cleverly placed incandescent indirect luminaires, and the incandescent reflector spots add dramatic and interesting high-



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If your regular electrical wholesaler stocks certified CBM ballasts for over-the-counter sale, he can give you an immediate, *free* replacement for any defective-in-warranty Sola fluorescent ballast you bring in.

Your wholesaler is able to provide this free service through a special arrangement with the Sola Electric Co., even if he does not stock Sola ballasts. Sola has authorized him to give you an equivalent certified CBM

replacement of another make if necessary!

Since actual records show that Sola ballasts have an unusually low failure ratio (chances are 714 to 1 against in-warranty failure of a Sola ballast), you'll rarely, if ever, find occasion to take advantage of this service. Should the need arise, however, feel free to call on any local wholesaler authorized as a Sola Ballast Service Center, for a free replacement from his stock.

**Send for  
Cross Index Ballast Chart:**

*Free chart lists Sola fluorescent ballasts and certified CBM equivalents, and shows you how to quickly and easily determine if a Sola ballast is in-warranty. Folds to 8½" x 11", is pre-punched to fit your standard 3-ring notebook.*

**SOLA** Electric Co.

4633 W. 16th St., Chicago 50, Ill.  
Bishop 2-1414

**TO: SOLA ELECTRIC CO.  
4633 West 16th St., Chicago 50, Ill.**

Please send me, without any cost or obligation, the "Sola Cross Index Ballast Replacement Guide."

My name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_, State \_\_\_\_\_

My regular wholesaler: \_\_\_\_\_

wholesaler's name

wholesaler's address

# Latrobe Electrical Products

"Latrobe" Floor Boxes and Wiring Specialties are designed for quick, easy installation and superior performance. Stripped of complex assembly, "Latrobe" Products do their job smoothly and economically.



**Two Gang Adjustable  
Floor Box**

Adjustable Boxes come in single-round or square bodies. Also in square type Single Gang, Two Gang, Three Gang and Four Gang Boxes. All adjustable boxes are now bonded which makes them fire-proof.

## Non-Adjustable Floor Box

Represents the last word in unique design, neat appearance, fewest number of parts, and least amount of labor to install.



## Insulator Supports

Malleable iron clamps of high tensile strength. Four sizes to fit all standard porcelain or glass insulators.

**Sold Only Thru Wholesalers**

## Latrobe Products

Non-Adjustable Floor Boxes  
Adjustable Floor Boxes  
Gang Boxes . . . Cover Plates  
Junction Boxes . . . Nozzles  
Pipe or Conduit Hangers  
Insulator Supports  
Cable Supports . . . Fish Wire  
Staple and Cable Clips

**Write for New Catalog**

Sales Representatives in all principal cities.



**DISPLAY LIGHTING** was intelligently planned to sell merchandise and to create an ideal customer environment in Kushin's Shoe Store, Walnut Creek, Calif.

lights. Wall paneling and floor textures are clearly defined and provide an attractive environment for the merchandise which is thereby exhibited to still greater advantage.

All of the lighting equipment in this outstanding installation was manufactured to architectural specifications and supplied by Peerless

Electric Co., San Francisco. Architect for the project was Robert A. Liles, of San Francisco, and the interior was planned by David P. Collins, industrial designer of Oakland. Fischbach and Moore, Inc., San Francisco electrical contractors, sold and installed the lighting and did all the electrical work involved.




## Pick-up Trucks Are Good Advertising Medium

Since motor shops are rarely visited by the general public, the average repair organization has little opportunity to visually impress prospective customers with whatever modern equipment, progressive methods, orderly operations or efficient practices they may have adopted for their shop, office or stock-room standards. Therefore shops should appreciate and fully exploit the opportunity for advertising these attributes through the medium of their trucks.


Barker Electric, located at Niagara Falls, N. Y., fully realizes that a sloppy, dirty, beaten-up business vehicle can only have a

negative influence upon their public reputation. Therefore their trucks are kept constantly in top-notch mechanical condition by careful maintenance, and constantly in public favor by meticulously obeying all rules dictated by traffic regulations, safety, and consideration for pedestrians and other vehicles on the road. The "proof of the pudding" has been furnished by numerous phone inquiries and many profitable orders resulting directly from initial, good impressions received by people who have first seen, noted and become familiar with Barker through the medium of his "cruising ambassadors".

A man in a dark shirt is perched on a metal ladder, leaning forward and pointing his right hand towards the text below. He has a questioning expression on his face.

**WHAT?**

***AB-I's eliminate the  
replacement nuisance?***

A man wearing a light-colored hard hat and a button-down shirt is standing and looking up at the man on the ladder. He is holding a Westinghouse AB-I circuit breaker in his arms.

**FOREVER.** And in many cases Westinghouse AB-I circuit breakers actually cost less than safety switches.

A flip of the handle restores power immediately after faults. With nothing to replace there is no time delay, no maintenance expense. There is no stock of replaceable devices to maintain—tying up valuable floor space. No need for capital investment to acquire such a stock.

Westinghouse unit breakers and enclosures are sold separately, for your convenience. Buy and install them as desired.

AB-I circuit breakers are the modern successor to the fused switch. Can you afford *not* to use Westinghouse AB-I circuit breakers? For further information ask your Westinghouse distributor for Descriptive Bulletin 30-250 or write Westinghouse, P. O. Box 868, Pittsburgh 30, Pa.

J-30225

**YOU CAN BE SURE...IF IT'S**

**Westinghouse**





# They cut your costs for four big reasons!

## The complete Black & Decker line is **POWER-BUILT** to speed up your jobs!

Whatever Black & Decker Tool you buy, *this* you can be sure of: (1) It will be powered by the best electric motor in the business. (2) Its balance, compactness and lightweight mean easier handling. (3) It will be versatile, driving many accessories from among the 1,000 *plus* Black & Decker offers. (4) Its rugged construction means less down time, lower maintenance.

Those are the reasons why B&D Tools help you save time, cut costs, take the hard work out of tough jobs. And why industry has made Black & Decker the world's largest builder of portable electric tools!

See your B&D Distributor for details—or write for Catalog No. 10 to: THE BLACK & DECKER MFG. CO., Dept. 2301, Towson 4, Md. (In Canada: 80-86 Fleet St., E., Toronto 2, Ont.)



LEADING DISTRIBUTORS EVERYWHERE SELL



# Black & Decker®

Portable electric tools . . . power-built to last!



(1) **TAILORED POWER** — Heart of every tool is a motor completely built by Black & Decker and tailored to the tool's specific needs.



(2) **STREAMLINED BALANCE** — Like this Scrugun®, all B&D Tools are designed for easier handling, less operator fatigue.

(3) **TOP VERSATILITY** — Typically, this Sander does a variety of jobs... sanding, grinding, wire brushing, buffing, wood planing.

(4) **EXTRA RUGGED** — This B&D Hammer, for example, handles the toughest jobs imaginable because it's *power-built to last*.





# In The News

## Electric Heat Gains in Utility Support

*Electric space heating is rapidly becoming the apparent answer to the great problems being created for electrical utilities by the unprecedented growth of the summer air conditioning load.*

This opinion was echoed in one form or another by more than two dozen speakers representing 14 utilities, eight manufacturers and four other industry groups at *Electrical World's Electric Space Heating and Heat Pump Conference* in New York City on December 5 and 6. The proceedings were attended by more than 200 utility management and sales personnel, manufacturers, and others. Primary objective of the program was to bring the experience of utilities successfully serving electric heating loads to other utilities who are now or will soon be faced with the summer peak problem.

The phenomenal growth of air conditioning has caused the maximum demand on many utilities' lines to appear during the summer months, when conductors and transformers are most adversely affected by heat. This results in the idleness of large portions of the utilities' generating and distribution capacities during the winter, when they are best adapted to handle the load. The economic implications were brought home by Gordon W. Evans, president, Kansas Gas & Electric Co., who revealed that \$24 million in that company's facilities were not used for eight or nine months during 1956, representing \$240,000 a month in interest, taxes and depreciation of equipment.

The summer peak problem was graphically illustrated by M. R. Rodger, senior marketing consultant with Middle West Service Co., Chicago. He disclosed results of a recent survey responded to by utilities serving 95% of the electrical load in the country. Replies showed that in 1950 summer peaks were experienced by utilities in six states serving 9% of the country's electrical customers and generating 15% of the total load. In 1955, the figures had increased to 14 states serving 30% of the customers and generating 24% of the load. Projecting this rate of increase indicates that by 1965 the figures will

be 30 states, 78% of the customers, and 71% of the load.

Logically, the load best suited to offset this summer peak and restore a year-round balanced load is one which is connected to the utility lines only when the air conditioning equipment is not. Electric heat fits this requirement.

The terrific stimulus to electrical consumption by complete electric heating was forcefully illustrated by W. T. Richards, vice president, Indianapolis Power and Light Co. He reported that extensive study of the company's all-electric load showed that the average 1250-sq ft home with an installed heating capacity of 12.5 kw consumed 22,850 kwhrs annually, while the same home without electric heat used 2600 kwhrs. Addition of air conditioning to the all-electric home added another 3400 kwhrs, a total of 26,250 kwhrs.

How is the utility industry reacting to the growing evidence pointing with favor to electric heat?

More than 50% of 137 utilities contributing information to a recent industry survey said they are now promoting electric heat or plan to in the near future. Many are engaged in studies designed to give reliable data on the diversity, load factor and demand of space heating loads.

Electric heat promotional activities described included concentrated programs of utility employee education and training, incentive pay and weekly prizes for sales people, sponsorship of all-electric model homes, use of electric heating for company offices, newspaper ads, radio and TV spot commercials, direct mail, distribution of articles and testimonials, equipment displays in company offices, budget billing, and special employee assistance plans.

Services being made available to customers by the utilities include the determination of heating and cooling capacities required, preparation of drawings and specifications, equipment recommendations, obtaining competitive bids, and furnishing supervising personnel



**A UNIQUE CHRISTMAS DISPLAY** on a construction job stopped traffic on New York's fabulous Fifth Avenue this holiday season. A Santa Claus 15 ft high, positioned astride the construction bridge projecting out beyond the building line over the sidewalk, holds a blueprint of the building and is shown "directing" the construction work. Five "pixie" helpers, 6 ft tall, are attached to the steel framework of the building. The entire display is illuminated at night by 40 floodlights of 300 watts each. The lighting was planned by Lawrence Lieberman of Central Queens Electrical Supply Co., Jamaica, and installed by Arc Electrical Construction Co., Inc. of New York City. The office building is being erected by the Tishman Realty & Construction Co., Inc.

**CONTRACTORS**  
**Call or write your**  
**COUCH**  
**representative**  
**for complete facts**  
**on the COUCH**  
**Fully-Automatic**  
**Audio-Visual**  
**Nurse Call System**

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**"or equal"**  
 is your cue to order



here's 3 good reasons why:

1. competitive price . . .
2. easy installation and maintenance . . .
3. plug-in electrical components . . .

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**Built-in  
 Dependability**

**S. H. Couch Company, Inc.**

**NORTH QUINCY 71, MASSACHUSETTS**

to insure proper installation.

Current estimates place the number of complete electric heating installations in this country between 250,000 and 300,000, including about 8,000 heat pumps. Heating saturation (or the percentage of heating load on a utility's lines) of 5% is not uncommon and has reached better than 20% in parts of Tennessee. Southern Nevada Power Co. reported the highest: 18,000 heating installations out of 30,000 meters, a saturation of 60%.

Utilities represented reported customer acceptance at a new high. Rates quoted averaged between 1½ and 1¾ cents per kwhr.

Cost of operation at 1½ cents per kwhr in the 2500-3000 degree-day zone served by the Georgia Power Co. averages 12 to 14 cents per sq ft per year for the properly insulated residence, stated C. M. Wallace, vice president of the company. Observed heating costs for 1000-sq-ft homes in the 5500-6000 degree-day Cleveland area average 16 cents per sq ft per year at an average 1.6 cents per kwhr, according to Jack Bruch, general supervisor, Cleveland Electric Illuminating Co.

In general, utilities making conscientious cost studies are finding operating costs lower than expected. Typical is the case quoted by M. G. Kennedy (Ebasco Services, Inc.): "Washington Water Power just completed a two-year test of 55 homes using electric heat. The results astonished them. They found that the cost of operation to the consumer was well below what the company had been publishing based on recognized heating calculation methods developed by professional groups." The company will go all-out for electric heating next year.

This practice of applying old standards and thinking to electric heating was assailed by Gordon Evans (Kansas Gas and Electric), who claimed that both the public and the heating manufacturers are ahead of the utilities in this respect. He said, "Many of today's problems and troubles (relating to electric heat) are due to lack of foresight and leadership in the past by top management—policy has been cautious and safe rather than forward-looking and progressive. The present problem of summer peak load *can* and *will* be met by planned sales."

M. G. Kennedy predicted the utilities' future course of action with respect to electric heat: "Life is much too short for us to try and reach 10,000 kwhr a year by promoting electric clocks!"

**CONTRACTORS**  
**Here are your**  
**COUCH representatives**

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 L. W. Oberacker, 145 High Street, Boston 10, Mass., Liberty 2-3323

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L. J. Daniels, Inc., 1622 Mathieson Bldg., Baltimore 2, Md., Plaza 2-7694  
 Maris Equipment Co., 2013 Locust Street, Philadelphia 3, Pa., Locust 7-3331, 2, 3  
 A. V. Peterson, Jr., Room 1030, 15 Exchange Place, Jersey City 2, N. J., Henderson 3-3432  
 Roy F. Thomas, P. O. Box 1804, Pittsburgh 30, Pa., Churchill 1-7683

**South**

J. Fred Hamrick, P. O. Box #9160, New Orleans 20, La., Audubon 0386  
 Walter F. Nelson Sales Agency, 813 Bona Allen Bldg., Atlanta 3, Ga., Murray 8-3111  
 L. W. Roberts Company, 15 Beard Bldg., 601 No. Elm St., Greensboro, N. C., Greensboro 8058  
 L. W. Roberts Company, 9 East Cary Street, Richmond, Va., Richmond 2-2214

**Mid-West**

Communication & Signaling Systems, Inc., 809 West Jackson Blvd., Chicago 2, Ill., State 2-7825, 7826  
 Kilkenny Company, 1729 Superior Ave., N.E., Cleveland 14, Ohio, Cherry 1-4306, 7, 8  
 H. P. Smith Company, 826-827 Andrus Bldg., Minneapolis 2, Minn., Federal 5-8327  
 G. H. Stienhans, 1913 Washington Ave., St. Louis 3, Missouri, Chestnut 1-0997  
 Stout Electrical Sales Co., 338 West Fourth Street, Cincinnati 2, Ohio, Dunbar 2744, 5

**South-West**

Fred Walters Company, 2020 Congress Street, Houston, Texas, Capitol 4-9676  
 Garnett Young & Co., 6131 North 18th Drive, Phoenix, Ariz., Alpine 4-4204

**Mountain States**

J. R. Christensen Agency, 247 East 5th St., South, Salt Lake City, Utah, Salt Lake 3-1600  
 Gregg M. Cloos Co., 977 Garfield Avenue, Denver 6, Colo., Florida 5-7274, 5

**West Coast**

Garnett Young & Co., 319 East Washington Blvd., Los Angeles 15, Calif., Rich 9-3351  
 Garnett Young & Co., 1238 N.W. Gilson St., Room 302, Portland 9, Ore., Capitol 7-2300  
 Garnett Young & Co., 390 Fourth Street, San Francisco, Calif., Douglas 2-4220  
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**Built-in  
 Dependability**

**S. H. Couch Company, Inc.**

**NORTH QUINCY 71, MASSACHUSETTS**



Sealtite protects leads to motor under a blanket of penetrating, chemical "snow"—powdered calcium sulphate, magnesium oxide and magnesium chloride.

## Sealtite Flexible Conduit ends circuit failures in chemical "snow" ... saves \$3 to \$5 per lead

Before Sealtite® came on the job, conduit carrying leads to electrical equipment didn't last long in this chemical "snow."

Six years ago, Westvaco Mineral Products Division of Food Machinery and Chemical Corporation began replacing leads with Sealtite flexible, liquid-tight conduit. Sealtite resists the action of the chemical "snow." Leads have stopped shorting out.

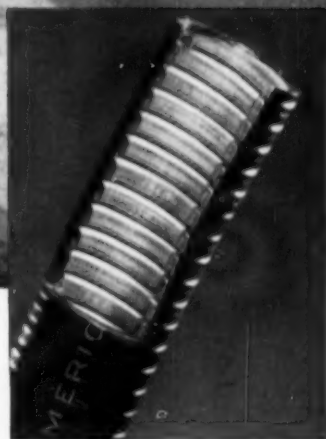
Westvaco saves money with Sealtite. They used to wrap ordinary flexible steel conduit with rubber tape, then give it two coats of a hard, protective varnish. That cost from \$3 to

\$5 per lead. Now they save this money. Sealtite has its own protective covering—a tough, extruded polyvinyl. But more important—since 1950 there haven't been any circuit failures at equipment protected by Sealtite.

What can Sealtite do for you? It resists oil . . . chemicals . . . corrosive atmospheres . . . weather. It absorbs vibration . . . protects wiring between moving parts . . . solves problems of misalignment. For complete information, write: *The American Brass Company, American Metal Hose Division, Waterbury 20, Conn.*

\*Trade Mark

2000 Rev.



Cutaway section of Type UA Sealtite shows tough polyvinyl covering over interlocked, zinc-plated steel strip. Copper conductor wound spirally in space between each convolution inside conduit provides positive ground.

**SEALTITE**  
FLEXIBLE, LIQUID-TIGHT CONDUIT  
AN  
**ANACONDA®**  
PRODUCT

Made in two types. Type UA approved by UL for service in wet spots. Type EF!—extra flexible—meets JIC standards. Available with jacket of machine tool standard light gray. Electrical wholesalers stock both types in easy-to-handle coils—you cut it on the job without waste.

1964 App. Pat.



# Make any type of conduit bend faster & easier



EXCLUSIVE  
CALIBRATED  
DEGREE SCALE  
ASSURES YOU OF  
ACCURATE BENDS  
EVERY TIME

## NO CHANGING PARTS

These are complete machines of all steel construction. No loose parts to be misplaced or lost. Machines are always in readiness to bend conduit easily and accurately.

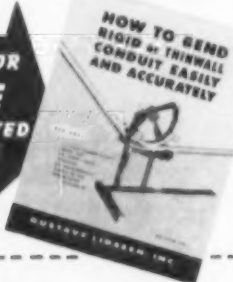
## RUGGED... LOW MAINTENANCE

Designed for real outdoor work. Machines incorporate a simple but powerful toggle-ratchet mechanism that requires no maintenance other than an occasional drop of oil. Rugged stand with built-in square and scale gives solid support at a comfortable working height.

## FASTER, SIMPLE TO USE

You get perfect, smooth uniform bends every time. Repeat bends and 180° bends are simple, easy to make. You turn out professional work quickly without special skill.

WRITE FOR  
**FREE**  
ILLUSTRATED  
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SEND TO:  
O. LIDSEEN, INC.  
1050 FIRST STREET, HAYESVILLE, N. C.

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COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

## 7.5 Mile Street Fluorescent Lighted

Dedication ceremonies for the new fluorescent street lighting system on New York City's Third Avenue, a street rich in history and tradition and dating back to pre-Manhattan days when it was an Indian trail, were held December 17, 1956. Hulan E. Jack, Manhattan Borough President, and Arthur C. Ford, Commissioner of Water Supply, Gas and Electricity, conducted the ceremonies, which included the presentation of plaques to the city from the Westinghouse Electric Corporation, suppliers of the new luminaires. Tomlinson Fort, vice president of the Westinghouse Apparatus Division, presented the plaques.

The new lighting system consists of 539 fluorescent luminaires along a 7.5 mile stretch of Third Avenue, extending from the Brooklyn Bridge at the South end to the Harlem River at the North end. The luminaires are spaced at 100-ft intervals on alternate sides of the Avenue. Each luminaire houses four 72-in. 100-watt fluorescent lamps. An average of 0.8 foot-candles of illumination is provided. This is New York City's first major fluorescent street lighting installation.

## NISA News

Frank W. Willey, retired president of Willey-Wray Electric Co. in Cincinnati and "Mr. NISA" to thousands in the electric motor service shop industry, was presented with a plaque for his services as national president by the Cincinnati Chapter on October 17. Mr. Willey served as president in 1935-36, two years after the organization was founded. He is still a director emeritus of the Association, the only member to hold that honor. The six living charter members of Cincinnati Chapter were present at the plaque presentation. They were Eddie Burns, Burton Hendrexson, J. Harry Hennequin, Edgar Conradi, Mr. Willey and Selden F. High, NISA director who presented the plaque.

The importance of community relations is being stressed by Penn Electric Motor Co. of Philadelphia as the shop conducts guided tours through its fractional horsepower repair operation for technical and high school students. Partners Jim

# BOSS

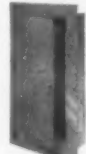
## JOB-ENGINEERED ELECTRICAL BOXES AND WIREWAY



• Build and maintain Customer Satisfaction

• Increase Sales and Profits

Job-engineered for quick, easy installation, BOSS boxes are code gauge steel, smooth corners, with firm but easy knock-outs. Finished in durable gray baked enamel. Complete line, from 4 1/2" x 5" x 3" to as large as needed. Surface or flush mount, with hinged or screw-on covers.

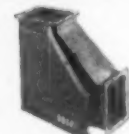


# BOSS

## FLANGED OR FLANGELESS WIREWAY WITH FITTINGS



BOSS Wireway and Fittings are easily adapted for "close fit" jobs where space is at a premium. Available in a wide range of sizes. Flangeless wireway is equipped with screw shields to protect wire as it is drawn through. Elbows, tees, closing plates. Telescoping fittings, nipples, hangers... these and other fittings are available in flanged wireway.



Better Buy BOSS... your all-in-one source for quality electrical boxes and wireway. Sold through distributors only. Write for catalog and complete information on the entire line.

**THE HUENEFELD CO.**  
CINCINNATI 25, OHIO, U.S.A.





**JOHN W. OVERTON**, Electric Motor & Repair, Richmond, Va.; Vice-President Alfred Elson, Jr., New England Machine & Electric Co., Pawtucket, R. I.; and Secretary Paul Sievert of Sievert Electric Co., Chicago, were busy during the NISA directors mid-year meeting in Pittsburgh.

and Joe Previty and Fred Pisano, all of whom have taught in vocational night schools, believe their action will have a favorable effect on future public appreciation of the growing motor repair industry.

Los Angeles Chapter visited Reuland Electric Co. in Alhambra, Calif., on January 8 and plans to inspect the new Hill Electric Co. of Los Angeles in February. The latter shop is a new company, formed when the parent company, the Hill electrical contracting firm, recently underwent reorganization and modernization.

At the meeting of the Cincinnati Chapter described above Frank Willey entertained the members with readings from a book he had compiled for the industry under the provisions of the National Recovery Act of 1933. It was a price book and one example Mr. Willey read was the rewind charge for a 5-hp, 1800 rpm motor. The price: \$37.00.

NISA President Charles J. Covington, Executive Secretary Fred B. Wiperman and staff assistant Joseph M. Harrington journeyed to New Orleans December 15 to attend the New Orleans Chapter Christmas party and to discuss the 1958 Convention of NISA which will be held at the city's Hotel Roosevelt.

Ken James of Metallizing Engineering Corp. of America was a speaker at the meeting of Puget Sound Chapter on November 18. In December the group held a dinner meeting in Tacoma, Wash. Hosts were Walt Harmer and Carl Storck of Center Electric and Engineering Co.

John Loyd of Loyd Electric Co. will be in charge of arrangements

## BIDDLE *Instrument News*

### Biddle Motor and Phase Rotation Tester (Dual Purpose)

With it you can . . .

- Determine the direction of rotation of electric motors before they are connected to the line.
- Determine the phase rotation or sequence of energized power circuits.



Here is a positive means for determining which motor leads must be connected to certain conductors of a supply system to insure that the motor will rotate in a prescribed direction when energized.

This device will permit the electrical contractor or industrial maintenance electrician to permanently connect and tape the terminals of the motor being installed, without having to first energize the motor by a temporary "hook-up" from a power source, if available, to determine its rotation.

Housed in a sturdy oak case  $12\frac{1}{4}'' \times 8\frac{3}{4}'' \times 4\frac{1}{4}''$  this compact unit weighs approximately 10 pounds and is supplied complete with 3 line and 3 motor leads which store in the compartments either side of the instrument panel.

For complete details write for Bulletin 80-ECM.

### Biddle Dielectric Test Set Model 1-40 KV

—for measuring d-c current at voltages up to 40 kv when applied to the insulation of such equipment as generators, transformers, bushings and cable.

Carefully considered safety features, excellent output voltage regulation, simple operation, compact design, and facilities for making voltage and current measurements at either polarity have been incorporated in this test set.

The set has a current rating of 25 milliamperes at short circuit, and current measurements can be made down to 0.5 microamperes which is the first division on the microammeter.

Overall dimensions are: height  $19\frac{1}{2}''$ , width  $13\frac{1}{2}''$ , depth 20 in., weight 120 lbs. All high voltage components are oil immersed.

For complete details, description, specifications, and prices, write for Bulletin 22-ECM.



James G. Biddle Co.  
1316 Arch St., Phila. 7, Pa.

Gentlemen: Please send me

- ☐ Bulletin 80-ECM  
☐ Bulletin 22-ECM

NAME

JOB FUNCTION

COMPANY

ADDRESS

## JAMES G. BIDDLE CO.

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

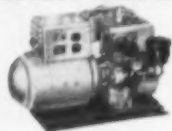
1316 ARCH STREET  
PHILADELPHIA 7, PA.

## WHEN POWER FAILS—

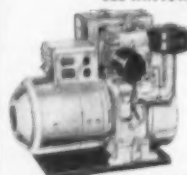
**YOUR WINPOWER**  
**EMERGENCY PLANT**  
*Takes Over Immediately*



### WINPOWER Electric Plants



800 WATTS AC



1,500 WATTS AC

#### CONTRACTORS

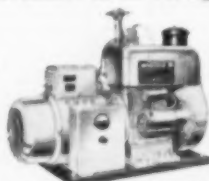
Portable units also available for operating contractors power tools.

Power failures occur when you least expect them. When a WINPOWER Plant is on the job, it takes over instantly no matter what the emergency. No interruption to lighting, heating, refrigeration, elevator operation or other electrical services.

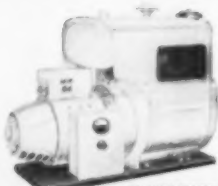
The new 1957 models are available in all voltages

and phases up to 100 KW—AC or DC. More than thirty years of experience guarantees top performance and long life. These plants powered by world famous engines are priced to beat all competition. Write for proof. No cost. No obligation.

**WINPOWER MFG. CO.**  
Dept. G 31 NEWTON, IOWA



5,000 WATTS AC



10,000 WATTS AC

## WHELOCK CODE CALL

*for immediate communication*

**Descriptive Bulletin 4B-3 available on request. Write for your copy now to Wheelock Signals, Inc. Long Branch, N. J.**

The busy switchboard operator just presses the button; a numerical code call sounds off throughout the building and the person being paged responds via the nearest telephone. The cycle is as simple as that. Also learn how easy it is to install a Wheelock Code Call System with any desired combination of chimes, bells, horns and other signalling devices.

*New*  
**CODE CALL SYSTEMS**



Wheelock Engineering & Mfg. Co. has changed its name to

**Wheelock SIGNALS**  
CODE CALL LONG BRANCH, N. J.

**Engineering Representatives in Principal Cities**

for the spring meeting of Southwestern Chapter, to be held at the Hilton Hotel in San Antonio on March 14-16. Mrs. Loyd is in charge of women's activities.

Southwestern Chapter is beginning to hold regional meetings. The first one, an East Texas meeting, was held on October 17 at Plaza Hotel in Tyler. The group expects to meet every five to six weeks, according to Southwestern Chapter executive secretary Ann Hickman.

Christmas parties were also held by NISA's Great Lakes Chapter on December 11 at Botsford Inn in Farmington, Mich.; by Quaker City in Philadelphia on December 12 and by Los Angeles Chapter on December 11. Santa Claus made a personal appearance at the Quaker City meeting, distributing gifts.

The president of Niagara Chapter and program chairman for the 1957 Convention, to be held at the Hotel Statler in Buffalo May 12-15 is Glenn Wardell of Wardell-Thurston Co., a shop man of diverse talents. Among his accomplishments, it was recently learned, is the building single-handedly of an attractive two-story house on the Erie Canal where he lives with his wife and two children. The ambitious project took him four years, nights and week-ends, to complete.

Mrs. Glenn Wardell, in addition to managing the house and family described above, is chairman of the women's activities for the Buffalo Convention. Assisting her are Mrs. Gladys Nelson (hostesses), Mrs. Dolores Worth (promotion), Mrs. Jessie Frostdick (Buffalo tour), Mrs. Margaret Barker (Niagara Falls tour), Mrs. Gloria Tanner (nursery), Mrs. Eleanor Volland (luncheon), Mrs. Harry Z. Lang Sr. (fashion show), Mrs. Alberta Keenan (information).

George McNally of Chicago Printed String Co. and R. A. Gillespie of Clark Controller Co. were featured on the program of the November 9 meeting of Central District (Chicago) Chapter.

"Metropolitan Chapter News and Chatter" is the title of a news bulletin now being published by New York Metropolitan Chapter. Dan Chiswick is editor.

A meeting of the Buffalo Convention Committee was held before the Niagara Chapter meeting November 16 and was attended by all

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You get all these *pluses* when you use Walker Rectifiers: low DC ripple — about 4% . . . low cost . . . long, efficient life . . . no maintenance. All Walker Rectifiers are designed and built to the highest standards, with the highest quality components.

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**LOOKING OVER** the coming budget of NISA are Treasurer Frank W. Ross, Ross-Electric Motor Shop, Fairmont, Minn., and President Charles J. Covington, Dowzer Electrical Machinery Works, Mount Vernon, Ill.

the women mentioned above in addition to the chairmen of all the committees for men's activities. At the Niagara Chapter meeting, guests included NISA directors Alex Shovan and H. C. Blenkhorn and *NISA News* editor Horace B. Barks. James McCarthy of Canisius College, Buffalo, spoke on the economics of copper.

The annual NISA Award Contest was officially launched with the distribution in December of posters for display in members' shops. Alex Shovan of Industrial Electric Service Co., Hawthorne, N. J., is chairman of the event which offers \$350 in prizes, including a \$100 first prize, a \$75 second prize and a \$50 third prize. Other prizes include a fourth prize of \$25 and ten honorable mention prizes of \$10 each. Moreover the shops whose employees submit the most entries and have the most winners will get \$25 apiece.

Prizes are judged on a point system which allots 20 points each for originality and adaptability, ten points for preparation, five points for construction and three for exhibit ability.

Judges besides Shovan are Edwin E. Kolhonen, Thomas Paul, John G. Persson and Frank W. Ross. Deadline for entries is March 15. Winners will be announced at the Buffalo Convention.

Among winners in a recent Delco dealers' contest were NISA members R. E. Colin, Sr. of Colin Electric Motor Service, Lincoln, Neb., who won a trip to Europe for two; L. J. Pizer of Weaver Electric Co., Denver, who won an automobile; and J. G. Hupp of Electric Motors Co., Cedar Rapids, Iowa, who won a week's tour of Mexico.

A fire destroyed the shop of New England Motor Service Corp. in

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38°  
**FIXTURE HANGER**

**EASIEST  
HANGER TO USE**  
**LOW-COST**

Makes fixture hanging a snap. Mounts directly on 3 1/4" or 4" outlet boxes. Grounds fixtures to conduit. Slots and off-set hooks provide adjustments up to 38°.

Seven styles, all low cost. Supplied with variety of receptacles from 115 V to 600 V. Each unit supplied complete with two 5' chains, hooks and cord clips.



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MODELS AVAILABLE**

SEE YOUR WHOLESALEMAN...OR SEND COUPON



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Brook Motors are available from warehouses at Chicago, Dallas, Jersey City, Los Angeles, Memphis, St. Paul, Salt Lake City, San Francisco, Savannah, Seattle, Tampa and other major distributing points.



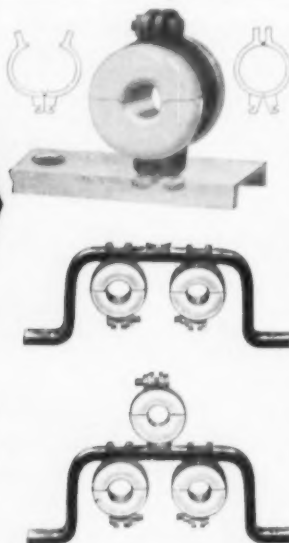
## BROOK MOTOR CORPORATION

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For QUICK, EASY, SAFE  
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NESTED  
CONDUCTOR RACKS

Efficiency Nested Conductor Racks are simple, compact and are scientifically designed to carry conductors equidistant from center to center. One bolt supports the bushings, and clamps the bushing support to the frame. Available in 2-3-4-5- and 6-bushing racks.

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**ELECTRIC AND MANUFACTURING CO.**  
EAST PALESTINE, OHIO

MANUFACTURERS OF EFFICIENCY  
ELECTRICAL DEVICES FOR CONDUIT  
AND WIRE CABLE SUSPENSION

Boston November 19, seriously burning the foreman Charles Zalewski. The explosion which is believed to have caused the fire occurred in a varnish dip tank. A fireman was cut by glass, but all other employees of the shop and an adjoining company escaped unharmed from the two buildings which were gutted by the blaze.

The firm is back in operation in an adjacent building which they owned. Zalewski is recovering and is expected back on the job shortly.

NISA President Charles J. Covington has urged the Association's membership to start off the year with improved methods, materials and services. "We must enlarge our services to our customers," he said in a message to members.

## Philadelphia Association Trains for Electric Heat

More than 50 Philadelphia electrical contractors and dealers have completed a four-week course conducted under the sponsorship of the Electrical Association of Philadelphia on the principles and practices of electric space heating. The four weekly sessions were designed to present in a practical manner the information required to figure and install a space heating job.

The first session was chairmaned by John A. Morrison, managing director of the Association. Stanley B. Aronson, sales manager of Berko Electric Mfg. Corp., gave pointers on how the market could be developed. Three Philadelphia-area electrical contractors, Jacob Frater, Walter Cottman and Irwin Hellerick, followed with a recounting of their experiences with electric heat. Frank Parsons of the National Mineral Wool Association topped off the meeting with the principles of heat transmission and the importance of building insulation.

The second session was devoted entirely to the determination of heat losses. Robert L. Boyd, development engineer with Electromode Div., Commercial Controls Corp., Rochester, N. Y., explained the provisions of NEMA's Electric House Heating Manual and worked out several examples with the group.

C. Fred Kreiser, sales manager for Edwin L. Wiegand Co., and Ray Johnson, Philadelphia representative of Berko Electric Mfg. Corp., started the third meeting with a discussion of equipment and control selection, followed by J. F. Lowry



of the Philadelphia Electric Co. on the utility's rate structure.

A demonstration and display of manufacturers' products during the last meeting gave the course members a look at heaters available.

Emphasis during the course was placed on the use of electric heating as an auxiliary and supplementary source of heat rather than as the primary source. Philadelphia Electric Co. still contends with a winter peak. As such it is reported not yet ready to go all-out for a program for complete electric heating for residential use, and a demand charge is currently imposed on complete installations. Spokesmen estimate that their situation will not change in this respect for at least three or four more years.

However, the diversity inherent in an auxiliary or supplementary heating installation makes it a desirable winter load. To this extent the utility is cooperating with the Electrical Association of Philadelphia in direct-mail promotion.

Training such as this course presented is viewed as a start toward providing qualified personnel who will be experienced in the application of electric heat when it becomes a major market.

## CLP Students Call "Objections" Main Worry

Contractors taking Los Angeles' Certified Lighting training course want more information on how to answer objections to relighting.

In a survey conducted at the end of the second CLP school sponsored by the Los Angeles bureau, 19 of 45 students asked that more class time be devoted to ways of overcoming sales resistance. Other areas in which students, the majority of whom were contractors, wanted more information included recommendations (checked by 11 of 45), "benefits" (by 9 or 45) and "the closing" (by 6 of 45).

The Los Angeles CLP unit, which is currently running a third class, also sampled student opinion on other facets of the course. Here are the highlights:

48% liked the balance between sales and engineering, while 45% wanted more engineering data.

The overwhelming majority preferred class-participation to the straight-lecture method.

80% preferred the "flux of light" to the watts-per-sq-ft method of lighting system design.

## api Radiantglass ELECTRIC HEATING



No. 2200

This beautiful API Radiantglass No. 2200, the most advanced of all bathroom heaters, turns pennies per hour into millionaire luxury. Thermostatically controlled, it features a night light and ladies' electric shaver outlet right in the control panel.

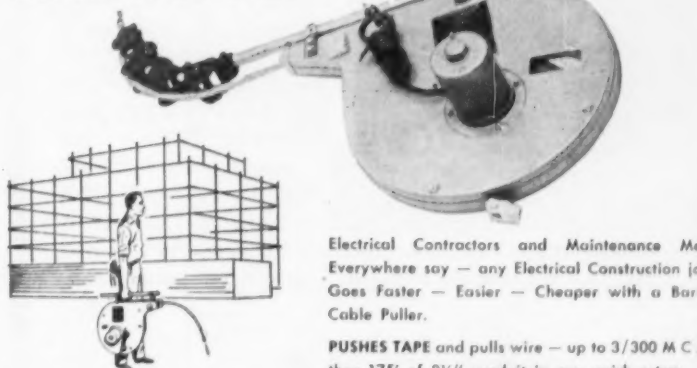
Write today for full information (Bulletin EC356) on the complete API Radiantglass line of time-proven electric heating equipment.

- Easy to install, operates on 120 volts AC.
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- Designed by Raymond Loewy Associates.
- Overall size 41" high, 12 7/8" wide.
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**The Best Possible Investment for any Electrical Construction Job!**



Electrical Contractors and Maintenance Men Everywhere say — any Electrical Construction job Goes Faster — Easier — Cheaper with a Barth Cable Puller.

**PUSHES TAPE and pulls wire — up to 3/300 M C M thru 175' of 2 1/2" conduit in one quick setup.**

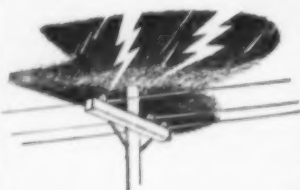
**THE BARTH CORPORATION** 12664 Brookpark Road, Cleveland 30, Ohio  
Please send complete Cable Puller data folder and prices.

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The Sangamo Heavy Duty Time Switch is the "no callback" time switch. It's *quality* all the way through—accurate . . . quiet . . . dependable. It's powered by the slow speed Sangamo-built motor that gives extra years of service. Heavy silver contacts and accurate, positive time settings add to the Sangamo reputation for quality.



**AUTOMATIC CARRYOVER**

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333 KVA Transformers. 33,500 x 67,000 volts, secondary 7620 volts, single phase, 60 cycle.

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WARREN, OHIO  
REPRESENTATIVES IN PRINCIPAL CITIES

95% said that, if the bureau furnished direct mail materials, they would mail it to their customers.

The biggest percentage said that they specialized in industrial lighting, rather than stores, offices, floodlighting, etc.

Questionnaire comments strongly supported the course, and often merit specific value to the student.

"Our third course, running from Oct. 2 to Nov. 20, is going well," according to Roy H. Kreysler, coordinating director. "We didn't have to solicit enrollment; there were enough students from among those who were denied admission, because of space, to the first two classes—and from others who had heard of the course."

**NAWB Plans 1957  
Commercial Promotion**

A program designed to help the industry up-sell the commercial and institutional wiring market will be launched in 1957 by the National Adequate Wiring Bureau.

The program, which takes NAWB into a new field, is based on a survey taken this year among contractors and utilities on the possibilities of the market. It will seek the support of the industry, and will furnish promotional material aimed at the commercial-institutional market. Specific plans will be announced later.

A NAWB task force set up the study, seeking contractor and utility opinion on the extent of potential business, the present degree of inadequacy, the need of help in selling and the principal obstacles to successful selling. One prime consideration was the varied needs of the market.

Here are the highlights of the survey findings:

Apartment houses are most handicapped in the use of electric power because of poor wiring. They require the most service calls and the most promotional help.

Typical retail establishments were believed the easiest type to improve by bringing wiring up to date, because they offer the greatest potential in terms of kwh. These establishments include supermarkets and small stores.

Office buildings were regarded as the easiest to sell on improved wiring and as offering the best opportunity to expand sales.

Direct mail, both nationally and locally, was seen as the best promotional approach to this market.

## WHAT'S THE LAW?

By Jack and Michael Strauss

**QUESTION:** Is an electrical contractor responsible for injuries that result from his work after completion and acceptance?

When Mr. Wright, an electrical contractor, finished wiring Mr. Cooper's newly erected factory building, he thought he had heard the last of that job. After all, he reasoned, Mr. Cooper had accepted the work. But, as it developed later, Mr. Wright was wrong.

After Mr. Wright had departed the job, Henry was hired to paint the exterior of the building. While he was 16 feet up, Henry came in contact with a dangling high voltage wire and, besides being badly burned, he was bounced off his scaffold to the ground below. Severely injured, he sued the surprised Mr. Wright for his injuries.

"As an electrician," Henry told the court, "Mr. Wright would have made a better plumber. Those wires were neither safely insulated nor grounded. The least he could have done was to have posted a warning sign that those wires were hot."

"He can't hold me responsible," the electrical contractor insisted in response. "After all, my work had been finished and accepted by Mr. Cooper when the accident occurred. If anyone should pay, it should be Mr. Cooper. He was supposed to have gotten those wires out of the way after I left the job, by attaching them to poles. It's not my fault he didn't do it."

**THIS WAS THE DECISION:** The court ruled that Mr. Wright did not have to pay. It said, as a general rule, an electrical contractor is not liable to a third person for damages or injuries by reason of his work when his work has been completed and turned over to and accepted by the owner. An exception to this rule, the court concluded, which is not applicable in this case, is when the defect is concealed or is inherently or imminently dangerous.

(Based upon 1932 and 1955 Connecticut Decisions. State laws vary. For personal guidance, see your local attorney).

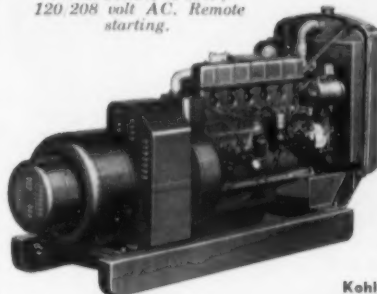


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*Stand-by power...*  
vital safeguard for  
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Model 50RB1, 50 KW.  
120, 208 volt AC. Remote  
starting.



Protect the interests of your customers by recommending Kohler stand-by electric plant installations before an emergency power failure. Kohler plants take over critical loads automatically. Insure uninterrupted use of light, heat, power. Cost is often less than losses caused by a single power stoppage . . . Use low-cost portable Kohler plants for on-the-job power that cuts work time. Operate floodlights, saws, drills, conduit cutters, other tools for wiring jobs. Two-wheel, rubber-tired hand cart available. Write for folder 7-A.

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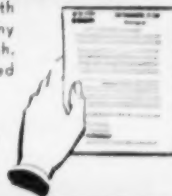
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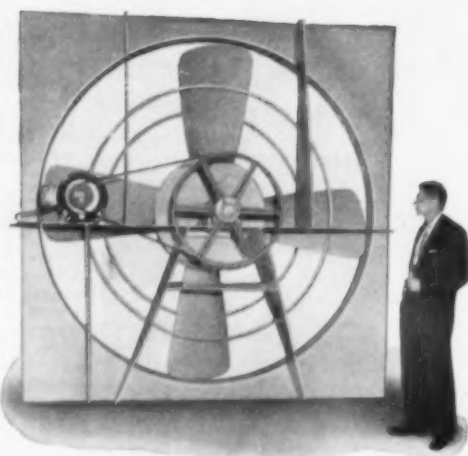
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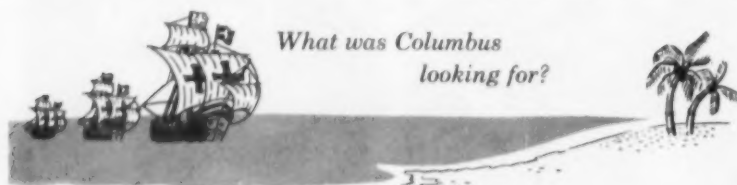
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*You'll find what you're looking for . . . with*



For years the name "Conduit of Columbus" has been the standard of leadership in conduit fittings. To positively identify this quality, specify the brand name "Columbus" conduit fittings. Ask for them by name.

CONDUIT PIPE PRODUCTS CO., COLUMBUS, OHIO

**SOLD ONLY THROUGH RECOGNIZED WHOLESALERS**

## DATES AHEAD

**American Institute of Electrical Engineers**—Winter general meeting, Hotel Statler, New York, N. Y., January 21, 25, 1957; Summer General Meeting—Montreal, Que. (Canada), June 24-28; Pacific General Meeting—Yakima, Wash., August 28-30; Fall General Meeting—Chicago, Ill., October 7-11.

**Plant Maintenance & Engineering Show and Conference**—Public Auditorium, Cleveland, Ohio, January 28-31.

**National Electrical Week**—An all-industry event, February 10-16.

**National Adequate Wiring Bureau Conference**—13th annual conference, Sherman Hotel, Chicago, Ill., February 21-22.

**National Electric Sign Assn.**—Annual convention and exhibit, Sheraton Park Hotel, Washington, D. C., February 24-28.

**American Society of Heating and Air Conditioning Engineers**—Annual meeting, Chicago, Ill., February 25-28.

**13th International Heating and Air Conditioning Exposition**—Chicago, Ill., February 25-March 1.

**National Electrical Manufacturers Assn.**—Edgewater Beach Hotel, Chicago, Ill., March 11-14.

**Illuminating Engineering Society**—Regional Conferences: Pacific Northwest—Empress Hotel, Victoria, B. C., March 28-29; South Pacific Coast—Statler Hotel, Los Angeles, Calif., April 3-5; Inter-Mountain—Hilton Hotel, Albuquerque, N. M., April 11-12; Southwestern—Holiday Inn, Oklahoma City, Okla., April 28-30; Midwestern—Astor Hotel, Milwaukee, Wisc., May 9-10; Great Lakes—Pantlind Hotel, Grand Rapids, Mich., May 13-14; Canadian—Sheraton Brock Hotel, Niagara Falls, Ont., May 16-17; East Central—William Penn Hotel, Pittsburgh, Pa., May 23-24; Northeastern—Hotel Statler, New York, N. Y., June 12-13.

**Edison Electric Institute**—23rd Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., April 1-4.

**Fourth National Electrical Industries Show**—Sponsored by Eastern Electrical Wholesalers Assn., 71st Regiment Armory, New York City, April 8-11.

**National Association of Lighting Maintenance Contractors**—Fourth Annual Meeting, Hotel Muelebach, Kansas City, Mo., April 29-May 1.

**Air Conditioning and Refrigeration Institute**—Annual meeting, The Homestead, Hot Springs, Va., May 6-8.

**Chicago Electrical Industry Show**—Conrad Hilton Hotel, Chicago, Ill., June 4-6.

**New York State Association of Electrical Contractors and Dealers, Inc.**—Annual convention, Saranac Inn, Saranac Inn, N. Y., July 25.

**Illuminating Engineering Society**—51st Annual National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

**National Electrical Contractors Association**—Convention and Exposition, Netherland Plaza and Sheraton Plaza Hotels, Cincinnati, Ohio, November 11-16.



# Among the Manufacturers

## Headquarters Announcements

General Electric Co. has formed a new Communication Products Dept. to absorb functions previously handled by the Communication Equipment Section. Harrison Van Aken, Jr., is to be general manager with headquarters at Electronics Park, Syracuse.

Electric Machinery Mfg. Co., Minneapolis, Minn., has formed a new subsidiary, Electric Distribution Products, Inc. in Allentown, Pa., for manufacture of "Uni-Bus" products. Executives are to be E. T. Carlson, vice president and general manager, and Lloyd H. Jones, sales manager.

Emerson Electric Mfg. Co., St. Louis, Mo.—George H. Childers, merchandise sales manager; Edward K. Handlan, manager of air conditioning sales.

Pyle-National Co., Chicago, Ill.—Jack Shearer, manager, Sales Connector Div.

Pittsburgh Reflector Co., Pittsburgh, Pa.—Frank E. Rickel, sales manager.

Hubbard & Co., Pittsburgh, Pa.—Charles H. Dyson, president, in addition to present duties as chairman of the board.

Air Reduction Sales Co., New York, has acquired assets and business of Jackson Products, Inc., of Detroit, manufacturing welding supplies.

Ramset Fastening System, Cleveland, Ohio—John Schwaller, advertising and promotion manager.

Sylvania Electric Products Inc., Salem, Mass.—S. George Lawson, operations manager in charge of photoflash and incandescent lamp operations.

Westinghouse Electric Corp., Bloomfield, N. J.—Charles T. Nichols, manufacturing manager; Marshall N. Waterman, commercial engineering manager; Large Lamp Dept.

Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.—Henry F. Dever, director of industrial control activities, in addition to duties as president of Brown Instrument Div.

John C. Virden Co., Cleveland, Ohio—Robert W. Minett, Jr., director of advertising and merchandising.

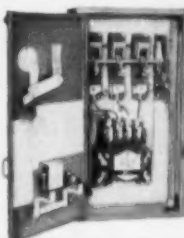
Stackpole Carbon Co., St. Marys, Pa.—H. S. Conrad, president; J.

## slash installation costs with **FEDERAL PACIFIC** Combination Motor Starters

*Finest Products Engineered*  
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COMPANY  
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**THERMAL MAGNETIC CIRCUIT BREAKER** permits harmless temporary overloads; trips instantly when overload becomes dangerous... offers quick-make, quick-break action, thermal tripping element and deionization arc quenchers.



**DISCONNECT SWITCH** designed for cool operation, safety and long life. Features clear visibility, positive circuit opening and silver plated current carrying parts.

**NOW** Federal Pacific does away with the need for separate motor controls and safety switches or circuit breakers! Now you can meet all your needs with one simple space-saving device... and save money while you do it! You install only one device—save valuable time—conserve precious space! Faster, easier installation more than offsets the slightly additional cost.

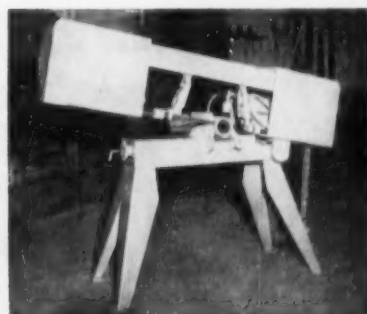
**Sound Powered TELEPHONES**  
work in any emergency

because they **NEED NO CURRENT**

If everything else fails, these phones will still provide trouble-free performance over a distance of many miles. Speaking is activated solely by the sound energy of the voice while ringing is accomplished by a hand-driven magneto. For permanent installation on industrial projects or for temporary use on construction work where they can be moved as the job progresses.

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In selective or common ringing and semi-selective or common talking. Cost of upkeep is negligible.

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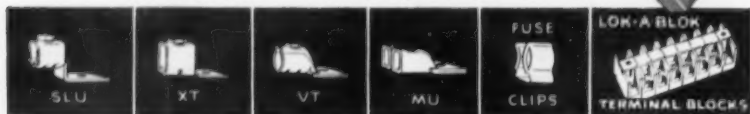
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Ohio Brass Co., Mansfield, Ohio—George L. Draffan, chairman of the board and chief executive officer; Roger A. Black, president.

Youngstown Sheet and Tube Co., Youngstown, Ohio—J. L. Mauthe, chairman of the board; A. S. Glossbrenner, president.

Lindberg Engineering Co., Chicago, Ill.—John R. Gorey, sales promotion manager, in addition to duties as public relations director.

Robertshaw-Fulton Controls Co., Philadelphia, Pa.—A. C. Hansen, national service director, with office in Long Beach, Calif.

Union Carbide and Carbon Corp., New York—R. K. Turner, vice president of Carbide and Carbon Chemicals Co., in addition to duties as vice president of Bakelite Co.

Day-Brite Lighting, Inc., St. Louis, Mo.—James F. Whitehead, Jr., executive vice president; George J. Taylor, vice president in charge of eastern operations.

Petersen Engineering Co., Santa Clara, Calif.—V. David Demarest, sales manager.

United States Steel Corp., Cleveland, Ohio—Harry L. Jenter, vice president—operations, American Steel and Wire Div.

Fasco Industries, Inc., Rochester, N. Y.—E. B. Thompson, sales manager, Appliance Div.

Howard Electric Co., Chicago, Ill.—Irwin F. Runge, national sales representative.

Controls Company of America, Milwaukee, Wis.—Stanley A. Johnson, director of manufacturing, A-P Controls Div.

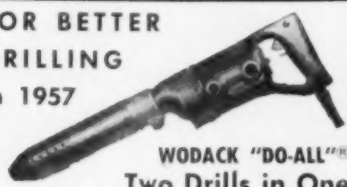
Yale & Town Mfg. Co., Philadelphia, Pa.—S. Wilson Clark, manager of export sales, Yale Materials Handling Div.

National Carbon Co., New York—Robert J. Zavesky, district works manager in charge of new plants in Columbia, Tenn., and Lawrenceburg, Tenn.; Carl E. Stollenmeyer, manager of Fostoria, Ohio plant; C. J. Parks, manager, Cleveland, Ohio plant.

Alpha Metals, Inc., Jersey City, N. J.—Harold Cohn to be in charge of Alpha-Loy Corp., new sales and manufacturing division in Chicago, Ill.

General Electric Co., Medium Transformer Dept., Rome, Ga.—K. P. Cox and S. A. Creson, Jr., traveling sales specialists.

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**WODACK "DO-ALL"®  
Two Drills in One**

Millions of holes will be drilled in 1957 and a considerable number of them with inefficient tools—tools not best suited to the drilling job.

The WODACK "DO-ALL" is an all round drilling tool, preferred by thousands of contractors and maintenance men. It's powerful, fast, dependable and economical. It's both a hammer for drilling concrete and masonry and a  $\frac{3}{8}$ " electric drill.

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solenoids,  
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New microfine burnishing element polishes as it cleans, leaving contacts mirror smooth. Use like a file, wear like a pen. \$1.50 each.

Also included: Additional element with slim-grip handle for hidden contacts.

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Cost...  
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Brushes are manufactured to size—need not be cut down to fit commutator. It pays to protect your electrical equipment with **HELWIG CARBON BRUSHES.**

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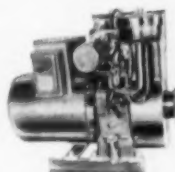
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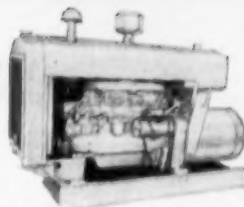
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### UNIVERSAL ELECTRIC POWER AND LIGHT PLANTS

New, low-cost,  
lightweight, air-  
cooled 3500 watt  
model.



New popular  
diesel model has  
25,000 watt  
capacity.



New models... both gasoline and diesel series... fastest deliveries... sure to please prices—that sums up Universal Electric Power and Light Plants—the fastest growing line today! Whatever you want in the broad 250 watt

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MARINE ENGINES

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Send me complete illustrated electric power and light plant literature and prices.

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Address .....

City ..... State .....

You can

treat 'em Rough

- the Reliable

**KNOPP**

Voltage Testers

can "take it"



Cost Less!

You don't baby the Knopp Voltage Testers. They're built to withstand the shocks of rugged daily use.

To save your time in testing you get the original patented Prod-Mount in the housing, making this tester easier and safer to use. You get the safety of dual indication of voltage by solenoid and neon lamp working independently. The scale readings are positive. Signal is by hum and vibration. Insulated for maximum protection.

It tells quickly if the circuit is open or closed; magnitude of voltage between 110 and 600 a-c or d-c, pure or rectified; 25 to 60 cycles.

The Knopp Voltage Testers have won fame from coast to coast among engineers, electricians and power companies. So why pay more for a tester when the Knopp Voltage Tester gives you more features and more value at less cost.

There are two models to choose from; pick up one at your dealer today or write for illustrated, free descriptive Bulletin No. 423.

The KNOPP  
Phase Sequence  
Indicator

60 v. to 600 v.; 25  
to 60 cycles; Ro-  
tating Indicator  
shows sequence  
A-B-C or C-B-A.  
Lightweight. Com-  
pact. Big time-  
saver.



**KNOPP INC.**

Founded in 1928 by Otto A. Knopp under the  
name of Electrical Facilities Inc.

4232 Holden St.

Oakland 8, Calif.

## Regional Appointments

### NEW ENGLAND

Black & Decker Mfg. Co.: Rowan A. Wernsdorfer, Northeastern regional service manager, Towson, Md.

Rockbestos Products Corp.: Joseph L. Feinberg, New England sales representative.

### MIDDLE ATLANTIC

Allis-Chalmers Mfg. Co.: Ralph L. Haney, manager of new branch office in Allentown, Pa.

Continental Electric Equipment Co.: Anderson and Levy Co., representatives in Philadelphia and upper Delaware Valley area.

Reliance Electric and Engineering Co.: Kenneth R. Wright, supervisor of new distribution center in Elizabeth, N. J.

P-W Industries, Inc.: Bradley Co., Inc., representative for Eastern Pennsylvania, Southern New Jersey, Delaware, Maryland, District of Columbia and Virginia.

### SOUTH ATLANTIC

Federal Pacific Electric Co.: John Chickering, branch manager, Washington, D. C. area.

John A. Roebing's Sons Corp.: John E. Heald, Mid-West representative, Construction Materials Div., office in Atlanta, Ga.

### EAST CENTRAL

Minnesota Mining & Manufacturing Co.: Richard A. Kelley, Chicago branch sales manager, Electrical Products Div.

Bulldog Electric Products Co.: M. V. Kessler, central regional manager, office in Columbus, Ohio.

General Electric Co., Silicone Products Dept.: Milton C. Lauenstein, district manager of new Chicago Sales District.

General Electric Co., Commercial and Industrial Air Conditioning Dept.: I. W. Pittleman, district manager, new Cleveland office; B. A. Wright, district manager, new Chicago office.

### WEST

Pyle-National Co.: William R. Raymond, West Coast regional manager, office in Los Angeles.

Hexcel Products, Inc.: J. C. Ep-person Co., sales representative in Northern Calif. and Nevada. Office in San Francisco.

Miller Co.: Robert C. Evans, sales representative, Utah-Idaho area, office in Salt Lake City, Utah.

McPhilben Lighting Co.: Joseph Pellicano, sales representative in Oregon and Southern Idaho, office in Portland, Ore.

General Electric Co., Silicone Products Dept.: Robert T. Daily, Western Sales District manager, office in Los Angeles.

**FOR  
LOWER COST  
FASTER DELIVERIES  
Turn to  
Spring City**



Because  
Spring City  
has foundry  
operations right

at the plant site, you can count on faster deliveries and lower cost. See for yourself. New Catalog 10 has just been published. Write for your free copy.

**JUNCTION AND PULL BOXES  
CONDUIT BOXES  
HINGED CABINETS  
EXPLOSION HOUSINGS  
MARKER LIGHT BOXES  
FIXTURE OUTLET BOXES  
SIDEWALK BOXES**



**SPRING CITY  
ELECTRICAL MFG. CO.**

Spring City 3, Pennsylvania



**THER  
RECTIFIER  
SPECIALISTS**

MEET EVERY  
D.C.  
REQUIREMENT

Selenium • Germanium  
Silicon • Tube

#### Standard Units:

From milliampere  
to 1000 KW.,  
fan or normal  
convection  
cooled. Specials  
to specifications.

#### Advantages:

Economical, quiet,  
compact, highly  
efficient. Removable  
panels. Circuit  
breaker and  
thermostatic switch  
protection on fan  
cooled models.

#### Accessories:

Voltmeters,  
ammeters, manual  
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variable voltage  
controls.



Send for  
informative  
Technical  
Bulletin



**THER ELECTRIC & MACHINE WORKS**

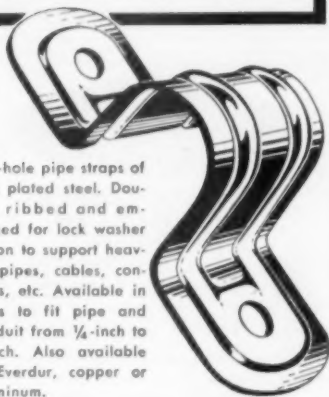
Established 1915

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**For Heavier Loads!**



Two-hole pipe straps of zinc plated steel. Double ribbed and embossed for lock washer action to support heavier pipes, cables, conduits, etc. Available in sizes to fit pipe and conduit from 1/4-inch to 6-inch. Also available in Everdur, copper or aluminum.

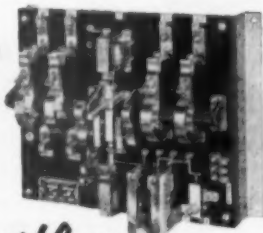
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**Specify MINERALLAC** HANGERS, CLIPS, STRAPS, BUSHINGS

MINERALLAC ELECTRIC COMPANY  
25 N. Peoria St., Chicago 7, Illinois

**MINERALLAC**

**FOR  
POWER  
THAT'S  
ALWAYS  
ON  
THE JOB**



*use...*

## ZENITH

**AUTOMATIC  
TRANSFER SWITCHES**

Zenith Automatic Transfer Switches assure full protection against any failure of regular voltage. Transfer to emergency power in a fraction of a second is automatic at 70% of line voltage. Regular power is restored at 90% of line voltage.

Simple design . . . sturdy construction . . . switches lock mechanically through trouble-free toggle action . . . no springs, latches or delicate mechanisms.

Available electrically or mechanically held, 30 to 400 amps.

Send for free catalog on complete Zenith line.

**ZENITH ELECTRIC CO.**

155 WEST WALTON STREET • CHICAGO 10, ILL.

## OUTLOOK FOR 1957

[FROM PAGE 88]

### Electric Power

This year it is anticipated that U. S. production of electric power will reach a total of three-fourths of a trillion kilowatt-hours, reports the Edison Electric Institute.

Installed generating capability of the total electric industry totaled 126.5 million kw at the end of 1956, an increase of 6.7 million kw during the year. During the next decade it is estimated that more than 110 million kw of net generating capability will be added. About 50 million kw of this additional generating capability is now on order.

Electric energy sales last year were about 529.6 billion kwhr (Chart IV) and an increase of about 7½% is predicted for 1957. Total power generated by all components of the electric industry last year were 601 billion kwhr, with an additional 84 billion kwhr being produced by industrial and railway generating plants.

Notable advances have already been made by the electric companies towards the utilization of atomic energy as a source of fuel for generating plants.

Currently some 49 electric power companies and associated service organizations are taking part in projects for the development and construction of eleven atomic power plants. Eight of these will have capacities of from 60,000 to 236,000 kw.

### Other Factors

The major appliance industry is going through what has been termed a "shake-down" period, but is beginning to stabilize, according to recent statements of industry leaders. Competition in this field is "more intense, more diversified and more imaginative than ever before, and a great deal more costly,—and it will continue to be so for a long time to come", reported one of these leaders. A critical problem has been that of distribution, with different companies approaching the problem in different ways.

The television industry will begin to stabilize and to become more profitable, it is predicted, despite

[Continued on page 238]

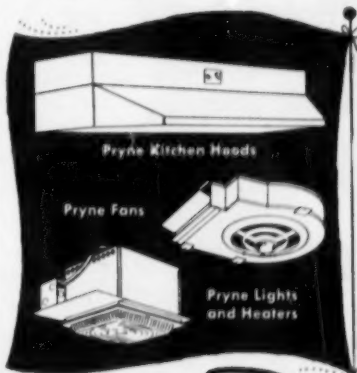
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new products  
for the home!**



Great new designs  
—'sales-engineered'  
for volume sales!  
Produced by skilled  
craftsmen...backed  
with 33 years  
of manufacturing  
'know-how'!



Before you buy  
or specify  
be sure to check  
how much further  
ahead you'll be  
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Pryne & Co., Inc. EC 1  
P.O. Box 698, Pomona, California  
Okay—please keep me posted on Pryne.

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Company \_\_\_\_\_  
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One Fixture Cost • One Installation Cost

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**HIGHER PROFITS FOR YOU**

**AUTHORITATIVE GUIDE**  
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IDEAS  
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FULL OF FACTS  
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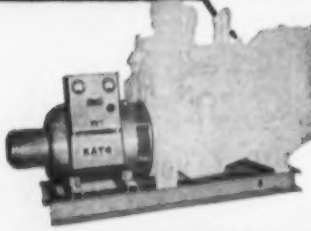
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**KATO**  
**GENERATORS**  
...adaptable to all well-known engines!

**FOR EMERGENCY AND CONTINUOUS DUTY!**



**CHOICE OF FIVE FLEXIBLE COUPLINGS**  
Adaptable to all engines with standard SAE BELL HOUSINGS

There is a size in the Kato line of generators with the electrical characteristics to meet your specific requirements. They hook up with any diesel or gasoline engine by means of one of Kato's flexible couplings. All standard frequencies... 25, 60, 60 and 400 cycles plus many special frequencies to 1200 cycles, (both fixed and variable). Now 400 cycles to 200 KW. 60 cycles to 500 KVA. One or two bearing design.



**MOTOR GENERATOR SETS**  
Wide variety of both fixed and variable frequency ranges starting at 25 cycles, up to 1200 cps. 400 cycle line now up to 200 KW.

**SPECIAL ORDERS WELCOMED!**

We Invite Your Inquiries Regarding Your Requirements

**KATO Engineering Company**

Write: 1442 First Ave. Mankato, Minnesota

the special deals, big discounts, trade-ins and special promotions which have been going on. In 1955 this industry sold 7,456,000 sets, and estimates are that 1956 would match that record, at a sales price net to manufacturers of about \$966 million. Color sets sold last year totaled about 150,000 and are expected to increase this year to 250,000. There are now an estimated 42 million TV sets in use.

Sales of home radio sets last year totaled about 8.1 million units, with a factory value of \$162 million. Set sales for 1957 are predicted at 8.5 million units, at about the same value.

Retail sales nationally last year were up about 3% from 1955, but in many localities the trend was down by a few points.

In 1956 business showed some signs of faltering—particularly in housing and consumer durables. But it was held up by the terrific strength of demand for capital goods.

In 1957 it appears that business activity generally will be better balanced and stronger, with government, business and consumer spending all making contributions. More explosions overseas, similar to those in recent weeks, could make the government's role the crucial one. But a year of high activity is assured without a deplorable assist from an armament boom. And as always, the capricious consumer will make the choice between a gentle rise and a jet-propelled take-off.



**E. C. GENTRY**, a foreman for Fisk electric Co., electrical contractors of Houston, Texas, is shown here outside the job shanty at the site of the new addition to the Herman Professional Building.

## WHERE To BUY

Equipment, Materials,  
Supplies and Services for  
Electrical Construction—  
Maintenance—Repairs

## ATLANTIC TRANSFORMER CO.

**MAKES TRANSFORMERS for  
EVERY VOLTAGE and  
INSTALLATION!**

Of course you want a smooth running plant. One answer is Atlantic custom built transformers—assuring you of highest efficiency, lowest losses—plus excellent regulation! There's a design to fit your needs perfectly... our engineers can suggest the correct models for your layout, and you get faultless installation and service. Care for the heart of your plant!

- Unmatched quality of construction!
- Lower initial cost and upkeep!
- Dependable, courteous service!

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**Atlantic Transformer Co.**

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PHILADELPHIA 20, PENNA.

**SUPERIOR TOP QUALITY  
AT LOW QUANTITY PRICES**

*Slimline*  
**FLUORESCENT LAMPS!**

choose the best  
**SUPRO LUX**

DEPENDABLE, HIGH LUMEN OUTPUT,  
TOP QUALITY, LONGER LIFE

write for our special low quantity prices

**SUPRO LUX**  
MANUFACTURING CO., INC.

406A EAST 161st ST., BRONX 51, N. Y.

## ROBOT OPERATORS

OPEN • CLOSE • LOCK! DOORS, GATES

...Electronically

COMMERCIAL, INDUSTRIAL

RESIDENTIAL & SPECIAL

Write for Catalog

**ROBOT APPLIANCES, INC.**

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Productive advertising is an investment rather than an expenditure.

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and MAINTENANCE**

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**AN ADVERTISING INCH** is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page. E.C. & M.

New ADVERTISEMENTS received at the New York office, 330 W. 42nd St., N. Y. 36, N. Y. by January 21st will appear in the February issue.

Indiana electrical contractor, Lowell Shaum, says he has finally licked the problem of backtracking from job to stockroom for materials. Journeymen take a "stockroom on wheels", right to the job and keep it there until the work's completed. This "stockroom on wheels" is a trailer, the **WELLS CARGO**, a Junior semi that hooks onto any station wagon, pickup, or panel truck, in three minutes' time. When the journeyman reaches the job, he simply unhitches the **WELLS CARGO** (it's free standing) and that leaves the truck itself free to go on other calls. What does a **WELLS CARGO** look like? How big is it? When you see one on the street, it will look like a cross country "semi"—only smaller. It's fully enclosed. Top and sides are aluminum, with double doors at the back. As for the size, there's a choice of one, two and four ton models. All are walk-in height with plywood floors and sides. Prices range from \$995 to \$1,295 F.O.B. factory. Most popular size, and the one used by Shaum is the tandem wheel 4-ton **WELLS CARGO**—about as long as a pickup truck. (This size is also used by General Telephone for maintenance and repair service, out in the field.)

Now if you're in the business of selling electrical contractors, and are free to handle something like the nationally advertised **WELLS CARGO**, let's get together and talk it over. The need for a "mobile stockroom" exists for practically every electrical contractor. (Even the one-man operator, because he can use a **WELLS CARGO** as his one and only stockroom!) The need is there because nobody can afford to waste precious man-hours. Man-hours lost in having to make a trip to find out what's needed. Man-hours in backtracking for supplies. Man-hours lost in the stockroom. And truck-hours lost because the pickup is tied up on the job. **LOST MAN-HOURS THAT ROB A CONTRACTOR OF HIS FAIR PROFIT.** Why else would contractors like Shaum own four **WELLS CARGO** trailers? But mighty few even realize that there's a way like this to save man-hours. That's where you come into the picture. Get the facts. Then spread the good word! Tell how man-hours saved, can pay for a **WELLS CARGO** in a matter of months. Why, just an hour a day saved is more than enough to make the monthly payments.

Certainly, we've got a proposition for you—one that will let you add several thousand dollars a year to your earnings with **NO** extra calls, **NO** financing, **NO** quota, and **NO** expense to you. Just one thing. This is an assignment only for salesmen—not order-takers. Write Mr. Don Reed, **WELLS CARGO** Division of **Prairie Schooner, Inc.**, Elkhart, Indiana.

**ELECTRICAL CONTRACTORS ESTIMATING HANDBOOK**

"A Unique Tool of the Trade"

WRITE FOR DESCRIPTIVE FOLDER TO THE ESTIMATOR PUBLISHING CO.

4102 Wilson Road Kenosha, Wis.

**SELLING OPPORTUNITY OFFERED**

**Manufacturers Representative Wanted**—Old established company changing from regional to national distribution seeks manufacturers representatives for all areas other than Middle Atlantic States for line of junction and pull boxes, explosion housings, cabinets, and other related products. Please include list of lines that you carry with your inquiry to Sales Vice President, Spring City Electrical Mfg. Co., Spring City, Pa.

**WANTED**

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Must be capable of assuming complete responsibility for all technical problems related to lighting engineering.

Salary commensurate with experience.

Location: New York City

We invite you to investigate this opportunity by forwarding a complete resume to:

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2 Rector Street, New York 6, N. Y.

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FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION

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PIERCE WIRE & CABLE CO.**

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Inspections Made Everywhere  
Firm Offers Cheerfully Made

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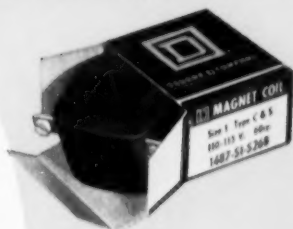
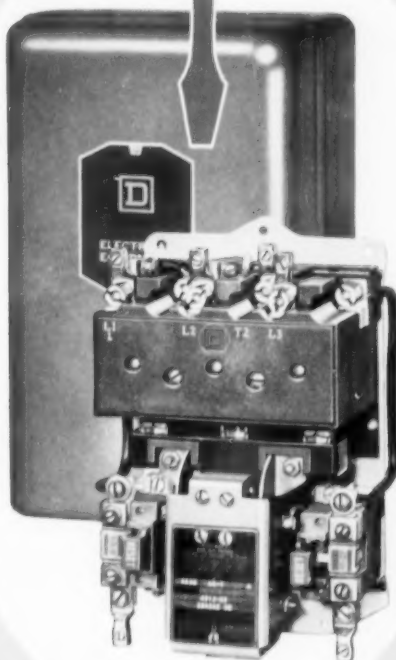
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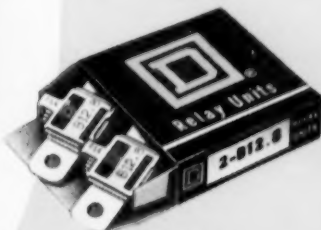
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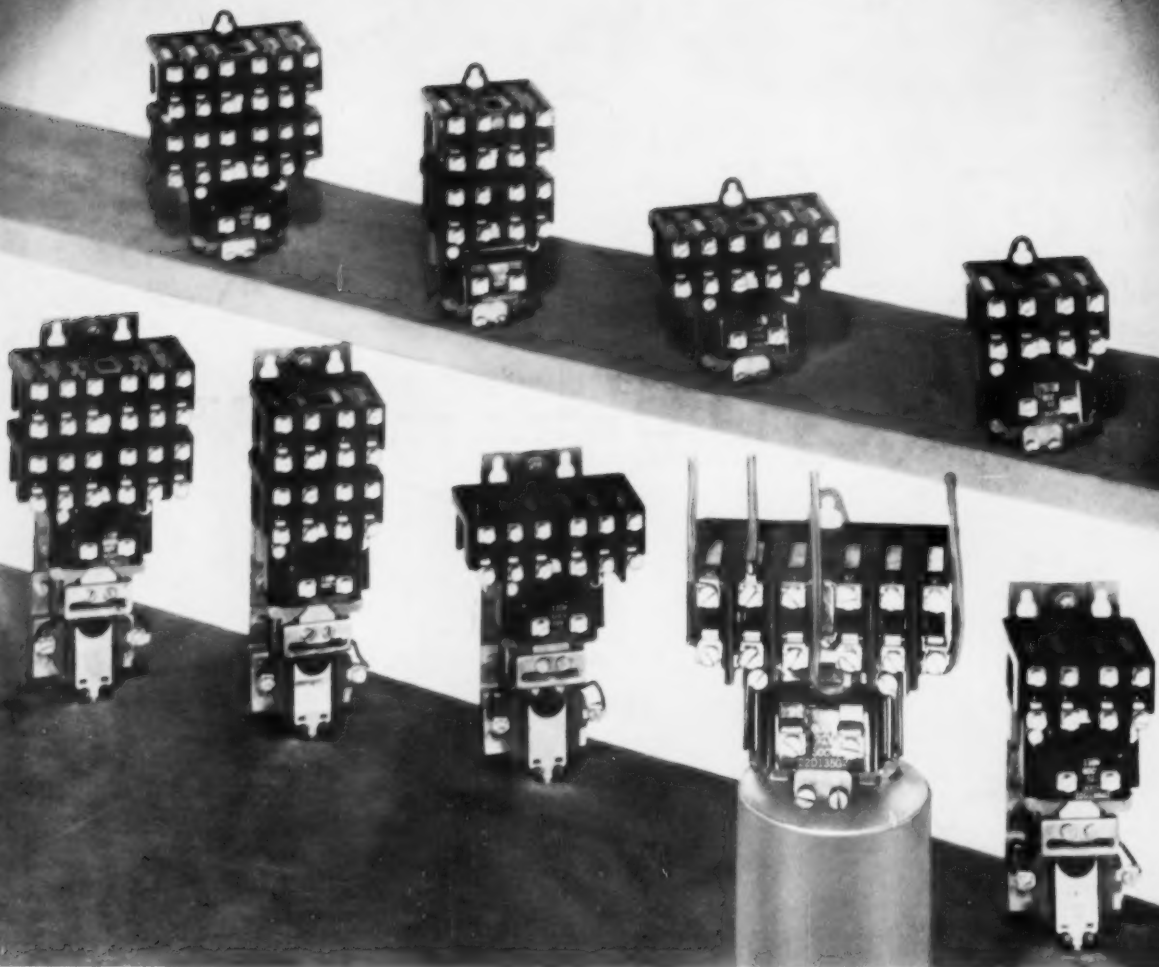
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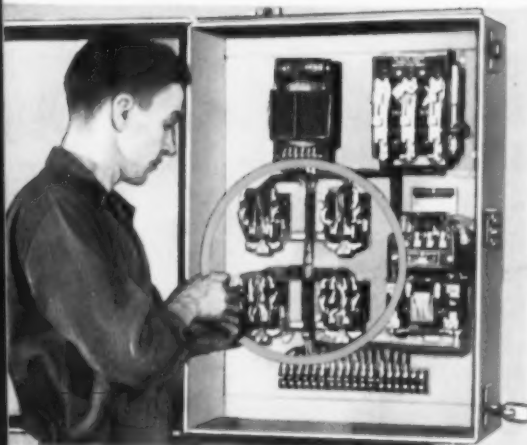


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